Research Article

Risk Assessment of Malignancy Index of Adenxal Masses in El-Minia University Hospital

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Abstract
Accurate prediction of malignancy in adnexal masses preoperatively is important for patient's counseling as well as for selecting the optimal operative approach. Several different modalities have been reported to predict malignancy in adnexeal mass. These include pelvic examination, trans-abdominal and/or transvaginal ultrasonography, tumor markers as CA١٢٥, lactate dehydrogenase and HCG levels and color Doppler. The aim of this study was to ascertain the utility of risk malignancy index in addition to power Doppler in predicting malignancy in an adnexeal mass. A total of ٥٢ women with diagnosed adnexeal masses who required operative intervention were enrolled in this study in the period between September ٢٠١١ and July ٢٠١٢. the women were recruited from the Gynecology Outpatient Clinic of El Minia University Hospital. All women had a preoperative the bimanual examination, measurement of the CA١٢٥, grey scale ultrasonography and power Doppler ultrasonography and Calculation of the risk of malignancy index (RMI) was done. The final diagnosis as gold standard was based on pathological findings. Statistical analysis was done using Student t-test, correlation test and chi- square test. For all the statistical tests done the threshold of significance was (P value <٠.٠٥). In comparing the diagnostic accuracy of US, Doppler, CA١٢٥ and RMI in predicting malignancy in adenexal masses in this study, the RMI had the highest diagnostic accuracy and predictive values (sensitivity of ٨٥ %, specificity of ٨٠٪, PPV of ٩٤.٤٪ and NPP of ٥٧.١٪) compared with CA١٢٥ (sensitivity of ٧٠٪, specificity of ٨٠٪, PPV of ٩٣.٣٪ and NPP of ٤٠٪), PI (sensitivity of ٨١٪, specificity of ٦٠٪, PPV of ٩٨.٥٪ and NPP of ٤٢.٩٪) and RI (sensitivity of ٨٥.٧١٪, specificity of ٤٠٪, PPV of ٨٥.٧٪ and NPP of ٤٠٪). We conclude on the basis of this study that RMI is the best predictor for malignancy in adnexeal mass. It is simple, non-invasive and accurate. The addition of power Doppler to RMI improve the diagnostic accuracy.
Key words: Malignancy index, Adenxal masses and Risk assessment

Introduction
Adnexeal mass is one of the most common indication of gynecologic intervention. They are common among women of all ages and two thirds of these masses are encountered during reproductive years.

Approximately ٤-٢٤٪ of adnexeal masses in premenopausal women and ٣٩-٦٣٪ in post-menopausal women (Finkler et al., ١٩٨٨).

Several different modalities have been reported in an attempt to predict malignancy in adnexeal mass. Accurate prediction of malignancy in adnexal masses preoperatively is important for patient's counseling as well as for selecting the optimal operative approach (laparoscopy versus laparotomy, incision type and operative procedures (cystectomy versus Oophrectomy). Several different modalities have been reported to predict malignancy in adnexeal mass. These include pelvic examination, transabdominal and/or transvaginal ultrasonography, tumor markers as CA١٢٥, lactate dehydrogenase and HCG levels and color Doppler. Recently attention have been focused on the use of power Doppler for prediction of malignancy in adnexeal masses. More recently the risk of malignancy index has been investigated for prediction of malignancy in adnexeal mass by

using combination of menopausal status, CA١٢٥ levels in U/ml and a morphology index using grey scale ultrasonography.

Prediction of malignancy has been preformed for many years using pelvic examination, ultrasonography, CA١٢٥ and Doppler. Although these modalities are useful and non invasive tools for predicting malignancy in adnexeal masses but cannot be used as a screening tool as it is increases in many other diseases.

The aim of this study was to ascertain the utility of risk malignancy index in addition to power Doppler in predicting malignancy in an adnexeal mass.

Materials and methods

A total of ٥٢ women with diagnosed adnexeal masses who requi-red operative intervention were enro-lled in this study in the period between September ٢٠١١ and July ٢٠١٢. the women were recruited from the Gynecology Outpatient Clinic of El-Minia University Hospital after being approved by departmental Ethical committee. A written consent was taken from all participants after explaining the study for them.

These patients were selected, regardless the patients complaint, age and parity, all patients were recruited according to the following criteria.

Inclusion criteria:

- All patient with suspicious adnexeal masses. The definition of suspicious adnexeal masses in the study was those which did not met all criteria of ultrasonarography for benignity and /or elevated CA ١٢٥ level (Chen et al., ٢٠٠٣).

The criteria of ultrasonarography for benignity:

١. Size < ١٠cm.
٢. Unilateral.
٣. Smooth border.
٤. No solid parts
٥. No fluid in culde sac

Patients with previous history of hysterectomy were included provided that has at least one adnexa. We exclude women who required an emergent laparotomy and those who had clinical or radiologic evidence of metastatic disease. In addition pregnant women were also excluded from this study.

All women had a preoperative bimanual examination, measurement of CA١٢٥, grey scale ultrasonography and power Doppler ultrasonography.

All women were subjected to the following:

١- History taking subjected age, menopausal status, residence, occupation and complain such as abdominal or pelvic pain, abdominal distension, dyspepsia, abnormal uterine bleeding, obstetric, past and family histories.

٢- Pelvic examination was performed preoperatively to assess mass size, mobility (mobile, partially mobile, or fixed), mass contour (smooth or nodular), and detectable ascites. Women were considered postmeno-pausal if they were older than ٥٠ years or if they had a serum FSH greater than ٢٥ U/L.

٣- CA١٢٥ assay: CA١٢٥ was measured using a radioimmunoassay technique (CA ١٢٥ radio-immunoassay, Abbott Laboratories, Chigaco, USA)., According to the recommend-dation of the manufacturer the CA ١٢٥ was considered abnormal if it is greater than ٣٥ U/ml.

Grey scale and power Doppler ultrasonography:

Both grey scale and power Doppler ultrasono-graphy were performed for all patients using a Toshiba ٣٠٠٠ A ٣-٥ MHz sector transducer for initial transabdominal imaging. Therefore, a ٧-٥ MHz transvaginal transducer was used for grey scale imaging. Information on tumor volume, suspected site of the mass, laterality, size of the mass, presence of septae and of papillary projectors, percentage of the solid component, overall echogenicty of the mass, presence of fluid in the Douglas pouch, presence of ascites and presence of metastases. papillary projection was defined as a solid tissue proliferated arising from the internal cyst wall with a height of ٣ mm or greater. Masses were classified as solid if solid tissue constitute at least ٨٠ % of the tumor and cystic if the solid tissue constitute less than ٨٠ % of the tumor. If any solid component was noted within the cystic lesion, the percentage of the solid tissue was calculated. The largest diameters of the solid component were measured in ٣ perpendicular planes, and the volume of the solid component was calculated by the same formula applied to the tumor

volume. Subsequently, the percentage of the solid component was calculated by the formula (volume of the solid component volume of the tumor) x ١٠٠. Metastasis was defined as presence of high- vascularity heterogeneous masses other than the primary tumor in the abdominal or pelvic cavity.

Doppler ultrasonarography:
After gray scale evaluation was completed, power Doppler sonography was performed on these masses. Doppler was performed on intratumoral vessels if present. If intratumoral vessels were not visualized, spectral Doppler readings were obtained from peripheral vessels. Pulsatility index (PI) and resistance index (RI) values were calculated. the lowest values were used when a reproducible of series of waveforms were obtained. A PI less than ١.٠ or RI less than or equal to ٠.٤ was considered suspicious. The sensitivity and specificity of various cut- off levels of PI and RI were calculated and the proper PI and RI cut- off values for differentiating the tumors were determined by receiver operator characteristics curve (ROC curve). All data were analyzed by using SPSS software version ١٥.٠ (Chicago, USA). The student t-test was used to compare mean RI and PI between the benign and malignant group and a P value of < ٠.٠٥ was considerable to be significant.

Calculation of the risk of malignancy index (RMI)
According to Jacob et al., (١٩٩٠) the RMI was calculated as follows:
RMI = U (ultrasound score) X M (menopausal score) X serum CA -١٢٥ level (units per liter).

Ultrasound findings (U): score of one point for each of the followings:

- Multilocular cysts (presence of one septum at least within the lesion).
- Presence of ascites.
- Bilateral lesions.
- Evidence of metastases.
- Evidence of solid areas.

Ultrasound scores:
U= ٠ (absence of any US finding)
U= ١ (presence of one US finding)
The final diagnosis as gold standard was based on pathological findings. Laparotomy was done for surgical management with peritoneal washing omentectomy and lymph node biopsy. The pathological diagnosis of borderline tumor was classified as malignancy. Therefore all of adnexeal masses were divided into ٢ groups as benign and malignant adnexeal masses.

Statistics:
Statistical analysis was done using Student t-test, correlation test and chi- square test. For all the statistical tests done the threshold of significance was (P value <٠.٠٥).

Results

Of the ٥٢ women included in this study, ٣٦ were premenopausal and ١٦ were postmeno-pausal. (٢٠٪) of the premenopausal women and (٢٥٪) of the post-menopausal women had a malignant tumor as shown in table (١). The histopathological diagnosis of adnexeal masses is shown in table (٢)

Table (١): The clinical characteristic of all patients

Patient characteristics	Benign (n=٤٢)	Malignant (n= ١٠)	P value
١-age: mean ±SD range	٣٧.١٩± ١٥.٧٤ (٩-٦٠)	٤٨.٨٠±٧.٣٠ (٤٠-٦٠)	٠.٠٠٢*
٢- parity: mean ± SD	٣.٧١± ٣.٢٠	١.٤٠± ٢.٠٧	٠.٠٣٥*
٣- Menopausal status: premenopausal N٠ (%) Postmenopasal N٠ (%)	٣٠(٧٨٣.٣٣٪) ١٢(٧٥٪)	٦(١٦.٦%) ٤(٢٥٪)	٠.٤٨٢
٤- Body Mass Index: Mean ± SD Range	٢٥.١١±٤.٨٥ (١٥.٦٢-٣٣.٢٠)	٣٤.٧٧±٨.٩٢ (١٩.٥٣- ٤٤.٩٢)	٠.٠٠٨*

٥- presence of pain: N٠ (%)	٣٦(٨٥.٧٠٪)	١٠(١٠٠٪)	٠.٤٤٦

This table shows the clinical characteristics of all patients and that there was statistically difference between benign and malignant masses as regarding age, parity and BMI in spite of increased incidence of malignancy with presence of pain and in postmenopausal women with no significant differences.

Table (٢): Histopathological diagnosis of adnexal masses in the studied population

Pathology	Frequency	Percent
Abscess	٢	٣.٨٪
Bilat papillary serous adenocarcinoma low grade	٢	٣.٨٪
Bilat poorly diff carcinoma	٢	٣.٨٪
Brenner's tumor	٢	٣.٨٪
Dermoid	٢	٣.٨٪
Dysgerminoma	٢	٣.٨٪
Endometrioma	٤	٧.٧٪
Fibroma	٢	٣.٨٪
Fibrothecoma	٤	٧.٧٪
Haemorrhagic cyst	٢	٣.٨٪
Mucinous cystadenofibroma	٤	٧.٧٪
Mucinous cystadenoma	٢	٣.٨٪
Non Hodgkin lymphoma of colon	٢	٣.٨٪
Papillary serous cystadenoma	٢	٣.٨٪
Poorly diff. carcinoma with omental metastasis	٢	٣.٨٪
Serous cyst	٢	٣.٨٪
Serous cystadenofibroma	٤	٧.٧٪
Simple haemorrhagic cyst	٢	٣.٨٪
Simple serous adenofibroma	٤	٧.٧٪
TB lesions	٤	٧.٧٪
Total	٥٢	١٠٠.٠٪

Correlation of the ultrasonarographic findings with the pathological findings.

Table (٣): The ultrasonographic parameters in relation to histopathology of masses.

US parameter	Benign (n-٤٢)	Malignant (n=١٠)	P value
١- Tumor volume: Mean±SD Rang	٣١١.٧١±١٨٨.٢٩ (٧٠-٦٨٨)	٦٧٣.٦٠±١١٦.١٤ (٥٧١-٨٩٠)	<٠.٠٠١*
٢- Bilaterality of masses : N٠(%)	٢(٤.٨٪)	٤(٤٠٪)	٠.٠٠٢*
٣- Echogenicity of masses			٠.٠٣٤*
Cystic : N٠(%)	١٤(٣٣.٣٪)	٠(٠٪)	
Solid : N٠(%)	١٠(٢٣.٨٪)	٦(٦٠٪)	
Mixed : N٠(%)	١٨(٤٢.٩٪)	٤(٤٠٪)	
٤- Presence of separate : N٠ (%)	١٨(٤٢.٩٪)	٦(٦٠٪)	٠.٣٢٨
٥- Presence of ascites :N٠ (%)	١٠(٢٣.٨٪)	٨(٨٠٪)	٠.٠٠١*
٦- Presence of metastasis: N٠ (%)	٢(٤.٨٪)	٦(٦٠٪)	<٠.٠٠١*

This table shows that there is statistical difference between benign and malignant masses as regarding US parameters (tumor volume, bilaterality, echogenicity of masses, presence of ascities and metastasis). But there was no significant difference regarding presence of septae.

Table (٤): Shows US score of benign and malignant masses.

US score	Benign (n=٤٢)	Malignant (n=١٠)	P value
Score (٠)	٦	٠	٠.٠٣١*
Score (١)	١٨	٢	
Score (٣)	١٨	٨	

This table shows that there is statistical difference between benign and malignant masses as regarding US score. (P value of ٠.٠٣١)

Correlation of Doppler application with the pathological findings:

Table (٥): Doppler parameters in relation to histopathology of masses

Doppler parameter	Benign (n=٤٢)	Malignant (n-١٠)	P value
١- Blood flow: **Peripheral N٠(%)** **Central N٠(%)** **Mixed N٠(%)**	 ٣٠(٧١.٤٪) ٦(١٤.٣٪) ٦(١٤.٣٪)	 ٢(٢٠٪) ٢(٢٠%) ٦(٦٠٪)	٠.٠٤*
٢- Pulsatility Index (PI) **Mean±SD** **Range**	 ١.٦٩± ٠.٦٥ (٠.٧٣-٢.٩)	 ١.٢٣ ± ٠.٣٩ (.٩-١٠٩)	٠.٠٠٨*
٣- Resistance Index (RI) **Mean±SD** **Range**	 ٠.٨١±٠.١٧ (٠.٤٣-١.٢)	 ٠.٦٤±١.٠ (٠.٥٢-٠.٧٧)	٠.٠٠٤*

This table shows that the presence of central or mixed blood flow was found more with malignant masses than that with benign ones. The difference is statistically significant (p value of ٠.٠٠٤). Also, there is statistical difference between benign and malignant masses as regarding PI and RI (p value of ٠.٠٠٨ and ٠.٠٠٤ respectively).

Correlation of serum CA١٢٥ level with the pathological findings:

Table (٦): Serum CA١٢٥ level in relation to pathology

	Tumor state	Mean	SD	Range	P value
CA١٢٥	Benign	٩٢.٣٣	٢١١.٧٩	٧.٤٠-٧٤٥	٠.٠٠٤*
	Malignant	٤٣٦.٣٠	٥٩٢.٦١	٢٢-١٥٣٧	

This table shows that there is significant difference between benign and malignant masses as regarding serum CA١٢٥ level (p value of ٠.٠٠٤)

Table (٧): Diagnostic indices of CA١٢٥ at cut- off value of ٣٥ u/ ml in differentiation between benign and malignant masses.

	Cut off	Sensitivity	Specificity	PPV	NPV
CA١٢٥	٣٥	٧٠٪	٨٠٪	٩٣.٣٪	٤٠٪

This table shows the accuracy of CA ١٢٥ serum level in differentiation between benign and malignant masses using cut- off value of ٣٥ u/ml.

Calculation of risk of malignancy index (RMI) and its relation to the pathology:

Table (٨): Risk of Malignancy index (RMI) in relation to pathology

	Tumor state	Mean	SD	Rang	P value
RMI	Benign	٢٧٥.٥٤	٦٤٢.٦٤	٠-٢٢٣٥	٠.٠٣٢*
	Malignant	١٧٥٦.١٠	١٤٨٢.٩٠	٢٢-٤٦١١	

This table shows that there is significant difference between benign and malignant masses as regarding Risk of Malignant Index (RMI) " p value of ٠.٠٣٢".

Table (٩): Diagnostic indices of RMI at cut – off value of ٢٦٥ in differentiation between benign and malignant masses.

	Cut off	Sensitivity	Specificity	PPV	NPV
RMI	٢٦٥	٨٥٪	٨٠٪	٩٤.٤٪	٥٧.١٪

This table shows the accuracy of RMI in differentiation between benign and malignant masses using cut- off value of ٢٦٥.

Table (١٠): Diagnostic indices of Doppler in differentiation between benign and malignant masses

Index (cut- off value)	Sensitivity	Specificity	PPV	NPP
PI< ١.٢٤	٨١٪	٦٠٪	٨٩.٥٪	٤٢.٩٪
RI <٠.٦٤	٨٥.٧١٪	٤٠٪	٨٥.٧٪	٤٠٪

This table shows the accuracy of Doppler indices (PI and RI) in differentiation between benign and malignant masses using cut-off value of ١.٢٤ and ٠.٦٤ for PI and RI respectively.

Table (١١): Diagnosis indices of CA ١٢٥, RMI and Doppler US in differentiation between benign and malignant masses

Variable	Sensitivity	Specificity	PPV	NPP
CA١٢٥ >٣٥	٧٠٪	٨٠٪	٩٣.٣٪	٤٠٪
RMI> ٢٦٥	٨٥٪	٨٠٪	٩٤.٤٪	٥٧.١٪
PI< ١.٢٤	٨١٪	٦٠٪	٨٩.٥٪	٤٢.٩٪
RI <٠.٦٤	٨٥.٧١٪	٤٠٪	٨٥.٧٪	٤٠٪

This shows the accuracy of CA١٢٥, RMI , PI and RI in differentiation between benign and malignant masses at their cut-off values.

Discussion

Ovarian cancer is the most important differential diagnosis of complex adnexeal masses, so should be excluded as early as possible. It is predominantly a disease of postmenopausal women and the incidence increases with age. (Danilovich et al., ٢٠٠١).

Malignant ovarian tumors are diagnosed at an advanced stage in ٧٥٪ of cases and are associated with the highest mortality figures of all gynecological cancers (Jemal et al., ٢٠٠٧).

It may be difficult to determine preoperatively the nature (benign or malignant) of adnexeal tumors, However, an accurate diagnosis is essential to provide optimal treatment. (Vergote et al., ٢٠٠١).

Good preoperative discrimination between benign and malignant ovarian tumors results in more women being appropriately referred for gynecologic oncology care and more women

with benign conditions undergoing conservative surgical treatment (Yazbek et al., ٢٠٠٨). In practice, most physicians used a combination of pelvic examination tumor markers assessment, gray scale US and Doppler characteristics to make a preoperative diagnosis of cancer especially to identify early stage ovarian cancer. Several studies have evaluated the ability of combination of different modalities to predict pelvic malignancy. However, non of these methods has gained widespread acceptance Recently, attention has been focused on the use of RMI in differentiating benign from malignant masses.

The aim of this study was to evaluate the use of risk malignancy index in combination with power Doppler in predicting malignancy in adnexeal masses. In the present study, ٧٥.٩٪ of the masses were found to be benign and ٢٤.١٪ of them were malignant. The incidence changes to be ٨٠.٨٪ for benign masses and ١٩.٢٪ for malignant ones due to bilaterality. The most common benign tumors are haemorrhagic cyst, fibroma, cystadenofibroma and T.B. lesions and most common malignant tumors is adenocarcinomas.

In this study, the mean age of benign cases was ٣٧ ranging from ٩ years to ٦٠ years and that of malignant cases was ٤٩ years ranging from ٤٠ years to ٦٠ years. Age alone was sensitive for predicting malignancy according to the results of this study, having a significant difference (p value of ٠.٠٠٢). These results coincided with those to Dotlic et al., (٢٠١١) who found that the mean age of patients with benign lesions was ٣٨ and for those with malignant masses was ٥١.٥ years with " P value of ٠.٠٠١"

In the present study, the mean value of parity have a significant difference (p value of ٠.٠٣٥) in relation to pathology, thus, the incidence of malignancy increased in low parity. This disagree with Yoruk et al., (٢٠٠٨) who found that the incidence of malignancy increased in high parity.

The main symptoms of all women were as follow pelvic pain in ٨٨.٥٪, abdominal enlargement in ٩.٥٪ and lastly abdominal uterine bleeding in ٤.٨٪. These figures correspond well with that of Dotlic et al., (٢٠١١)

As regard to the BMI we found that the mean body mass index of patients with benign tumors was ٢٥.١١±٤.٨٥ and that of malignant ones was ٣٤.٧٧±٨.٩٢ with significant differ-rent (P value=٠.٠٠٨) in relation to pathology. Thus BMI values are significantly higher in patients with malignant tumors than benign ones. This coincides with Dotlic et al., (٢٠١١) and Yorul et al., (٢٠٠٨).

Postmenopausal women were ١٦ patients accounted for about ٣٠.٧٧٪ of patients in the present study, and the incidence of malignancy in these postmenopausal women was found to be ٢٥٪ and premenopausal women were ٣٦ patients accounted for ٦٩.٢٣٪ and coincidence of malignancy in this group was ٢٠٪. Thus incidence of malignancy increases in postmenopausal women with non-significant difference (P value of ٠.٤٨٢).

According to various studies, most ovarian tumors ٨٠٪ to ٨٥٪ are benign and two thirds of these occur in women in reproductive years. Approximately ٤-٢٤٪ of adnexeal masses in premenopausal women and ٣٩-٦٣٪ in postmenopausal women were malignant. (vasilev et al., ١٩٨٨)

The ultrasound score alone as a predictive value for malignancy in masses of the studied population has a significant difference (P value of ٠.٠٣١) in correlation to pathology. In this study, the mean tumor volume of patients with benign masses was ٣١١.٧١±١٨٨.٢٩ and that of malignant ones was ٦٧٣.٦٠±١١٦.١٣ with highly significant difference (P value < ٠.٠٠١). This indicate malignancy increases with increased tumor volume. Also, most of malignant tumors are bilateral (٦٠%) while ٤.٨٪ of benign tumors are bilateral with significant difference (P value of ٠.٠٠٢).

It was noted in this study that ١٠٠٪ of malignant tumors have solid or mixed echogenicity while ٦٦.٧٪ of benign ones have this with significant difference (P value of ٠.٠٣٤), thus increased solid parts of the tumor increases incidence of malignancy. This coincidence with Yoruk et al., (٢٠٠٨).

Presence of septae (multilocularity) is an U/S feature suspicious of malignancy. In the present study ٤٢.٩٪ of benign tumors have septae while

٦٠٪ of malignant ones have this with no significant difference (p value of ٠.٣٢٨).

Also the presence of ascites and metastasis are U/S features suspicious of malignancy in the present study. Ascites and metastases present in ٨٠٪ and ٦٠٪ of malignant tumor respectively while present in ٢٣.٨٪ and ٤.٨٪ of benign tumor respectively with highly significant difference (p value of ٠.٠٠١ and < ٠.٠٠١ respectively) this coincides with yoruk et al., (٢٠٠٨) with "P value of ٠.٠٤ and ٠.٠٠٥" respectively. Folkman et al., (١٩٧١) first described the importance of angiogenesis for tumor grown. In our work, we support the hypothesis that ultrasonographic evaluation of tumor angiogenesis might help to improve differentiation between benign and malignant ovarian tumors detected in screening trials, as reported by Carmeliet et al., (٢٠٠٠).

As regards the use of power Doppler in differentiating benign from malignant masses the mean R١ and RI were ٠.٨١ and ١.٦٩ respectively for patient with benign masses and that for those with malignant masses were ٠.٦٤ and ١.٢٤ respectively. The difference was statistically significant (P < ٠.٠٥).

At cut –off values of "٠.٦٤" and "١.٢٤" values for RI and PI respectively the diagnostic accuracy of Doppler shows a sensitivity of ٨٥.٧١%, ٨١٪, specificity of ٤٠٪, ٦٠٪, positive predictive value of ٨٥.٧٪, ٨٩.٥٪ and negative predictive value of ٤٠٪, ٤٢.٩٪, respectively. This coincides with Neeyalavira et al., (٢٠٠٨) using cut- off PI value of ١.٢٤, giving the sensitivity and specificity of ٩٥.١٪ and ٨٨.٣٪, respectively and RI value of ٠.٦٤ as the cut- off point, the sensitivity and specificity were ٩٥.١٪ and ٩٠.٣٪ respectively. Sengoku et al., (١٩٩٤) reported sensitivity and specificity of ٨١.٣ and ٩١.٧٪ respectively when the cut-off value of PI was ١.٥. Timor- Tritsch et al., (١٩٩٣) reported the RI value of ٠.٤ had sensitivity ٩٣.٨٪ and specificity of ٩٨.٧٪ which was different from the study of Zanetta et al., (١٩٩٤) (RI ٠.٥٦). Maly et al., (١٩٩٥), revealed a cut off value of ٠.٦ for RI with a sensitivity of (٦٧٪), specificity of (٥٣%), PPV of (٢٢%) and NPV of (٨٧٪). Ebrashy and Ezzat (٢٠٠٠), found RI of ٠.٤٥ to be of ٨٦٪ sensitivity while Marret et al., (٢٠٠٢), reported a cut off value of ٠.٥٣ for RI with a specificity of ٩٣٪.

In general, both indices tended to be lower in malignant masses than in benign masses (Flesicher et al., ١٩٩٣ and Brown et al., ١٩٩٤). Although there are different opinions about cut-off values, all authors agree that recognition of angiogenesis as a reference point for malignant changes within the ovary has proved to be a highly sensitive parameter. Given that neova-scularizaiton is an obligate event in malignant change, this recognition may enable us to observe the earliest stages in ovarian onco-genesis. Neeyalavira V et al., (٢٠٠٨) and Guerriero et al., (٢٠٠١), concluded that at least one of the two Doppler techniques, pulsed wave Doppler should be used in conjunction with gray scale imaging in order to decease the false positive rate of gray scale imaging when used alone.

In this study, with Doppler examinations the presence of central or mixed blood flow was greater in malignant lesions (٨٠٪) than benign lesions (٢٨.٦٪) and this difference was statistically significant (P<٠.٠٠٤). This coin-cides with Yoruk et al., (٢٠٠٨). In the present study the mean CA١٢٥ serum level was ٩٢.٣٣ u/ml for the women with benign masses and ٤٢٦.٣٠ u/ml for those with malignant masses. The difference was statistically significant (P value of ٠.٠٠٤). At a cut-off value of ٣٥ u/ml, CA١٢٥ had a sensitivity of ٧٠٪, a specificity of ٨٠٪, a positive predictive value of ٩٣.٣٪ and a negative predictive value of ٤٠٪. These figures coincide well with that of Timmerman et al., (١٩٩٩) who reported that CA١٢٥ had a sensitivity of ٧١٪ for stage one primary ovarian cancer, ٩٤٪ for all other primary invasive ovarian cancer,٧٧٪ for metastatic ovarian cancer and ٦٠٪ for borderline malignant ovarian tumors.

In the present study, Risk of malignancy index was calculated for each patient in the studied population. The mean value for benign tumors was ٢٧٥.٥٤ ranging from ٠ to ٢٢٣٥ and for malignant one was ١٧٥٦.١ ranging from ٢٢ to ٤٦١١. At a cut- off value > ٢٠٠ or ٢٦٥ provides sensitivity of ٨٥٪, specificity of ٨٠٪, positive predictive value of ٩٤.٤٪ and negative predictive value of ٥٧.١٪ for both values with significant difference (P value of ٠.٠٣٢). The presence of gap between two cut-off values (٢٠٠, ٢٦٥) with the same accuracy could be explained by the small sample size of the

studied population, presence of gap in the levels of serum CA١٢٥ and unilaterality of most masses (٨٨.٤٦٪ of the cases, with low US score).

This results coincides well with that reported by Jacob et al., (١٩٩٠) at a cut-off point of ٢٠٠ to have a sensitivity of ٧٣٪ and a specificity of ٩١٪ (for a RMI based on CA١٢٥, ultrasound and menopausal status). Similarly, Tingulstad et al., (١٩٩٦ and ١٩٩٩) found a sensitivity of ٧١٪ and specificity of ٩٦٪. In a later study in ١٩٩٩ Tingulstad et al., reported a sensitivity of ٧١٪ and a specificity of ٩٢٪ respectively. Also, Bouzari et al., (٢٠١١) found a sensitivity of ٩١.٣٪, specificity of ٨٨%, PPV of ٥٢٪ and NPV of ٩٨.٥٨٪. In an extensive retrospective analysis, Bailey et al., (٢٠٠٦) confirmed the effectiveness of the RMI algorithm for identifying cases of ovarian malignancy presenting at cancer units for subsequent referred to a cancer.

In comparing the diagnostic accuracy of US, Doppler, CA١٢٥ and RMI in predicting malignancy in adenexal masses in this study, the RMI had the highest diagnostic accuracy and predictive values (sensitivity of ٨٥٪, specificity of ٨٠٪, PPV of ٩٤.٤٪ and NPP of ٥٧.١٪) compared with CA١٢٥ (sensitivity of ٧٠٪, specificity of ٨٠٪, PPV of ٩٣.٣٪ and NPP of ٤٠٪), PI (sensitivity of ٨١٪, specificity of ٦٠٪, PPV of ٩٨.٥٪ and NPP of ٤٢.٩٪) and RI (sensitivity of ٨٥.٧١%, specificity of ٤٠٪, PPV of ٨٥.٧% and NPP of ٤٠%).

Conclusion

We conclude on the basis of this study that RMI is the best predictor for malignancy in adnexeal mass. It is simple, non invasive and accurate. The addition of power Doppler to RMI improve the diagnostic accuracy.

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