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Efficiency of Ultrasound in Detection of Ovarian Tumors

Yasir Osman Elbadawi[1*], Raga Ahmed Abouraida Ahmed[2], Ahmed Alsharef Farah[3], Hussein Ahmed Hassan[4], Mohammed Algum Elamin[5], Sami Elgak[6]

[1]College of Graduate Studies and Scientific Research, Karary University, Khartoum, Sudan
[2]Department of Radiological Sciences, College of Applied Medical Science, King Khalid University, Abha, Saudi Arabia
[3]College of Medical Radiologic Sciences, Karary University, Khartoum, Sudan
[4]College of Graduate Studies and Scientific Research, Karary University, Khartoum, Sudan
[5]Al-soudy Maternal Hospital, Khartoum, Sudan
[6]Department of Radiological Sciences and Medical Imaging, College of Applied Medical Science, Majmaah University, Majmaah, Saudia Arabia

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***Corresponding author:** Yasir Osman Elbadawi
College of Graduate Studies and Scientific Research, Karary University, Khartoum, Sudan

Abstract

Introduction: Determining whether an ovarian tumor is benign or malignant before surgery can change the treatment plan and aid in early identification. Transvaginal ultrasonography, in particular, is a useful technique for ovarian tumor detection. Early diagnosis is crucial since the majority of ovarian cancers are epithelial ovarian cancers (EOC), which grow quickly. Treatment can be more successful if a gynecologic oncologist is consulted right away to diagnose the type of tumor. ***Methods:*** A descriptive cross-sectional study was conducted among 400 patients presenting with adnexal masses at the Saudi Hospital for Obstetrics and Gynecology in Khartoum, Sudan, from January to May 2025. Transvaginal and abdominal ultrasonography were utilized to evaluate adnexal lesions. Data on patient demographics, symptoms, and medical history were analyzed to assess correlations with ultrasound findings and final diagnoses. ***Results:*** The study found that the most affected age group by ovarian tumors was those in 26-40 years, which constituted 42% and 41-55 years represented 28.25%. Approximately 43.3% of patients were asymptomatic, more than half were symptomatic, with pain being the most prevalent symptom. Ultrasonography classified 68.8% of masses as benign and 22% as malignant. Significant associations were found between ultrasound features, such as irregular contour, ascites, papillary projections, and vascularity, and the presence of malignancy. Older age and a history of breast cancer were also significantly associated with malignant lesions. Statistical analyses demonstrated that specific ultrasonographic features effectively predict ovarian malignancy. ***Conclusion:*** Ultrasonography is an efficient and dependable method for identifying, assessing, and categorizing ovarian cancers. Combining the patient's age, medical history, and ultrasound characteristics improves diagnostic precision, enables prompt and effective treatment, and lowers the risk of surgery.

Keywords: Diagnostic ultrasound, Ovarian tumors, Benign, Malignant.

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INTRODUCTION

Often, ovarian masses are discovered by accident, and identifying benign versus malignant ovarian masses is essential to choosing the appropriate treatment. Ovarian cancer is the seventh most common type of cancer in women, making up 3.7% of all cancers [1]. At some time in their lives, 5–10% of women will undergo surgery to remove a suspected ovarian tumor [2]. With a total of 65,538 newly reported cases, the age-adjusted incidence rate in Europe in 2012 was 13.1 per 100,000 women. Ovarian cancer is a serious gynecological health concern since it can be lethal; in 2012, it was responsible for 42,700 deaths in Europe (mortality rate: 7.6 per 100,000). [3]

Since epithelial ovarian cancer (EOC), which makes up the majority of ovarian malignancies, develops quickly, early detection of ovarian cancer is essential. Treatment can be more successful if a gynecologic oncologist is consulted right away to diagnose the type of tumor. Determining whether an adnexal mass is benign or malignant prior to surgery can change the course of treatment. Tumor markers and radiological

imaging are the most commonly utilized techniques.[4] According to previous research, between 5% and 40% of adnexal cysts are malignant. This means that patients with benign or ambiguous cysts may have to wait longer for treatment instead of being transferred for unnecessary surgery. [5,6]

Soft tissue anatomy, development, and lymph nodes can be evaluated using imaging techniques such as computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound (USG). The most common method for identifying pelvic and abdominal disease is ultrasound, which can be either transvaginal or abdominal, and is the first-line test prior to surgery for ovarian tumors. Normal and malignant adnexal masses can be reliably distinguished with this non-invasive imaging method.[7]

A CT scan and an MRI are then conducted to determine whether there is nodal involvement, the extent of the disease in the upper abdominal area, the mass's structure, and whether the mass's origin is the gastrointestinal tract, urinary system, or retroperitoneum. Because it depends on the operator's experience, subjective pattern recognition evaluation with USG is operator-dependent. [8,9]

PATIENTS AND METHODS

This retrospective study was conducted from January 2023 to May 2025, involving a total of four hundred patients. This was conducted at the ultrasound department. The study utilized an ultrasound system model Samsung sonocare R7, with curved linear arrays and an endovaginal transducer, manufactured in KOREA, 2013. All patients included in the study underwent a comprehensive medical history review.

Ultrasound methods such as trans abdominal (TA) and trans vaginal (TV) are frequently used to examine the female pelvis. To identify the uterus and adnexa as a summary of the other pelvic tissues, the TA examination is performed from the anterior abdominal wall using a curvilinear, or sector, transducer at frequencies of up to 5 MHz. The enlarged bladder is typically used as a "sonic" window for TA scans. If the protocol requires a TA trial to be conducted in addition to a TV study, not all institutions begin with the bladder fully dilated. Even when the bladder is empty or only slightly enlarged, a TA scan might be helpful as a comprehensive evaluation of the pelvic tissues. Higher transducer frequencies of 7.5 MHz or higher are employed, and the patient's bladder is empty during the TV examination. The enhanced near-field focusing and resolution of these higher frequencies allow for more detailed characterization of the uterus and adnexa. To evaluate the female pelvis, transvaginal and transabdominal sonography are complementary techniques that are frequently employed. Both approaches should be utilized to identify anatomy and disease in at least two orthogonal planes, usually sagittal and axial or coronal and transverse.[10]

Fig 1: Transvaginal ultrasound image for a 53-year-old who presented with no symptoms and a history of breast cancer, shows a left ovarian lesion with a solid component and irregular contour measuring 3.35×3.67 cm

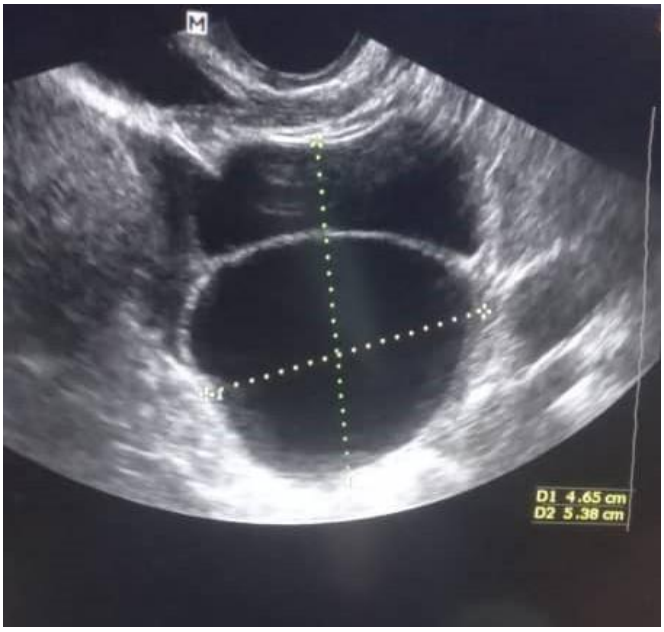

Fig 2: Transvaginal ultrasound image for a 41-year-old who presented with vaginal bleeding and a history of ectopic pregnancy shows a left ovarian unilocular lesion, measured 4.65×5.38 cm

Fig 3: Transvaginal ultrasound image for a 38-year-old who presented with pelvic pain and no history, shows a right ovarian lesion with a solid component measuring 7.17×5.82 cm

METHOD OF DATA COLLECTION

The data collection sheet used to collect the data had the following variable: The variables in the study were divided into four sections: demographics, including participant age, was covered in the first section; signs and symptoms were covered in the second; clinical history was included in the third; and ultrasound findings were covered in the fourth.

Data analysis

The demographic data, which were given as mean (± standard deviation), morphometric traits, and Doppler measures, were compared using the independent samples T-test and the chi-squared test for both continuous and categorical variables. The statistical analysis was conducted using SPSS (version 21; SPSS Inc., Chicago, IL), and the significance threshold was set at p-value<0.05.

Ethical consideration

The study was initiated after obtaining approval from the Institutional Review Board (IRB) and the local ethics committee (IRB) of the College of Graduate Studies and Scientific Research, Karary University, Khartoum, Sudan. A consent form was obtained from all individual participants included in the study, which was used for research purposes and scientific publications.

Identification information is kept private and is not accessible to anyone except the research team. All data sheets were password-protected and distributed exclusively to the research team.

RESULT

In this retrospective study, four hundred pelvic ultrasound examinations were performed using sonographic features to classify ovarian tumor types.

Table 4-1 frequency distribution of age groups

Age		Frequency	Percent
Age group	18-25	87	21.75
	26-40	168	42.0
	41-55	113	28.25
	More than 55	32	8.0
Mean = 36.96 years			

In this study, it was found that the most affected age group by ovarian tumor was those in 26-40 years and 41-55 years, constituting 42% and 28.25% respectively, followed by the younger age group 18-25 years, 21.75 %, the mean age was 36.96 years. Table 4-1. **Table 4-1**

Table 4-2 frequency distribution of signs, symptoms, and history

Categories		Frequency	Percent
Signs and symptoms	Asymptomatic	173	43.3
	Pain	148	37.0
	Vaginal bleeding	19	4.8
	Irregular period	16	4.0
	Vaginal Discharge	15	3.8
	Constipation	10	2.5
	Menopause	8	2.0
	Difficult urination	7	1.8
	Menorrhagia	3	0.8
	Abdominal Pain	1	0.3
History	No-history	261	65.3
	Post operation	51	12.8
	Ectopic pregnancy	30	7.5
	Breast cancer	20	5.0
	Hysterectomy	19	4.8
	Miscarriage	18	4.5
	Cancer	1	0.3
Total		400	100.0

The results showed that the asymptomatic females were 43.3%. More than half were symptomatic, with the most prevalent symptoms being pain 37.0%, then vaginal bleeding, irregular cycle, and vaginal discharge 4.8%, 4.0% and 3.8%. The majority have no history 65.3%, 12.8% and 7.5% have a history of post-operation and ectopic pregnancy, and 5.0% have breast cancer. **Table 4-2**.

Ultrasound findings according to sonographic appearance

Table 4-3 shows the frequency distribution of the findings according to sonographic appearance

Features		Yes		No	
		Frequency	**Percentage**	**Frequency**	**Percentage**
Benign	Unilocular	114	28.5	286	71.5
	Solid component less than 7 mm	169	42.3	231	57.7
	Acoustic shadow	88	22	312	78
	Multilocular >10mm without solid areas	21	5.3	379	94.7
	Absent vascularity	0	0	400	100
Malignant	Solid with irregular contour	84	21.0	316	79.0
	Ascites	31	7.8	369	92.2
	More than 4 papillary projections	12	3	388	97
	Multilocular > 10 with solid areas	5	1.3	395	98.7
	Abundant vascularity	9	2.3	391	97.7

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Concerning the lesion features which was described according to sonographic appearance about 28.5%, 42.3 %, 22% and 5.3% having features which were unilocular, solid component less than 7mm in diameter, acoustic shadow and multilocular without solid component and concerning malignant features 21%, 7.8%, 3%, 1.3% and 2.3% having a Solid with irregular contour, Ascites, Multilocular > 10 with solid areas and Abundant vascularity respectively. **Table 4-3.**

Table 4-4: shows the frequency distribution of diagnosis according to sonographic appearance

Final diagnosed	Frequency	Percent
Benign	275	68.75
Malignant	88	22.0
Inconclusive	37	9.25
Total	400	100.0

Concerning the classification of lesions according to sonographic appearance, most lesions were categorized as benign 68.8%, followed by malignant 22.0% and then inconclusive 9.3%., which carried at least one feature of benign and one of malignant Table **4-4.**

Table 4-5 shows a comparison of age and the presence of symptoms.

Group	N	Mean Age	SD	P-value
Presence of Symptoms	229	34.2	10.5	0.03*
Asymptomatic	173	38.7	12.1	
*Significant P-Value less than 0.05				

Table 4-6: Cross tabulation between diagnosis and demographic age, symptoms and, history

		diagnosis			Total	P value	Chi^2	Cramer's V
		Benign	Malignant	Inconclusive				
Age group	18-25	72	10	5	87	<0.001**	40.112	0.224
	26-40	126	29	13	168			
	41-55	66	37	10	113			
	>55	11	12	9	32			
Signs and symptoms	Abdominal Pain	1	0	0	1	0.542	16.726	0.145
	Asymptomatic	117	42	14	173			
	Constipation	5	4	1	10			
	Difficult urination	4	2	1	7			
	Irregular period	11	5	0	16			
	Menopause	4	2	2	8			
	Menorrhagia	1	1	1	3			
	Pain	105	27	16	148			
	Vaginal bleeding	17	2	0	19			
	Vaginal Discharge	10	3	2	15			
History	Breast cancer	6	10	4	20	0.003**	29.974	0.193
	Cancer	1	0	0	1			
	Ectopic pregnancy	20	9	1	30			
	Hysterectomy	10	4	5	19			
	Miscarriage	10	7	1	18			
	No-history	188	51	22	261			
	Post operation	40	7	4	51			
Total		275	88	37	400			

Significant correlation was noticed between age and final diagnosed with the malignancy features based on sonographic appearance were more common in pre- and post-menopausal patients (40 years and more) than younger age group, furthermore among more than 55 years the malignant and inconclusive lesion features were more common than benign features (21 related to 11 cases respectively), the strength of association was low as Cramer's V = 0.224 and p< 0.001. insignificant correlation between sign and symptoms and diagnosis, p > 0.05; furthermore, significant correlation between history and mass feature with those with previous feature of breast cancers were likely to develop malignant tumors than benign ones, p value =0.003, weak association as Cramer's V = 0.193. Table **4-6.**

Table 4-7 shows the Chi-Square test results for age and sonographic feature presence

Feature	Mean Age (Feature Present)	Mean Age (Feature Absent)	P-value	CI (95%)
Benign				
Unilocular	42.3 years	33.1 years	0.005*	**0.001–0.005**
Solid <7mm	45.8 years	31.4 years	<0.001*	0.001 – 0.004
Acoustic shadow	43.2 years	34.6 years	0.042*	0.001 – 0.052
Multilocular >10mm w/o solid areas	41.8 years	33.9 years	0.031*	0.001 – 0.042
Absent vascularity	39.5 years	36.2 years	0.22	0.10–0.20
Malignant				
Irregular contour	45.2 years	33.4 years	<0.001*	0.001 – 0.022
Ascites	47.1 years	34.2 years	<0.001*	0.001 – 0.035
>4 papillary projections	44.3 years	35.0 years	0.003*	0.001 – 0.010
Solid >10mm with solid areas	45.5 years	36.8 years	0.008*	0.001 – 0.022
Vascularity	44.0 years	35.3 years	0.015*	0.001 – 0.052
*Significant P-Value less than 0.05				

DISCUSSION

This study assessed the efficiency of ultrasound in the detection of ovarian tumors.

The current study's findings indicated that the age groups most affected by adnexal mass were 26–40 years old (42%) and 41–55 years old (28.0%), with a mean age of roughly 37 years. These findings were consistent with a 2017 study by Sugandha Garg *et al.,* which found that the mean age (SD) was 42.5 years [11].

According to the study's findings, women made up the majority of those with symptoms, accounting for over half. The most common symptoms were pain (37.0%), followed by vaginal bleeding, irregular menstruation, and vaginal discharge (4.8%, 4.0%, and 3.8%, respectively). The majority have no history, while 5.0% have breast cancer, and 65.3%, 12.8%, and 7.5% have a history of ectopic pregnancy and post-operative complications. This finding runs counter to the research conducted by Carvalho JP *et al.,*2020 who reported that the majority of adnexal tumors are benign and that no symptoms were discovered by chance [12].

The majority of ovarian tumors are benign, according to the study's findings in Tables 4.3 and 4.4, which suggests that ovarian tumors can be evaluated using their sonographic appearance. This result was consistent with a 2020 study by Paula Carvalho *et al.,* that showed most adnexal masses are benign.[12] It also supported a 2017 study by Di Legge *et al.,* that found that invasive or borderline malignant tumors were present in a reduced number of ovarian lesions, whereas the majority of lesions were benign.[12]

Utilizing a t-test to compare the mean ages of individuals with and without symptoms. The average age of symptomatic patients is 34.2 years, which is much younger than the average age of asymptomatic patients, who are 38.7 years old. This difference is statistically significant, as indicated by the P-value of 0.03; it suggests that older patients are typically asymptomatic, while younger patients are more likely to develop symptoms related to their disease. This outcome was consistent with a 2020 study by Carvalho JP *et al.,*[12]

Based on ultrasound features, malignancy features were more common in pre- and post-menopausal patients (40 years and older) than in younger age groups. Additionally, among those over 55, malignant and inconclusive lesion features were more common than benign features (21 related to 11 cases, respectively). The strength of the association was low, with Cramer's V = 0.224 and p<0.001. Table 4.6 demonstrates a significant correlation between age and final diagnosis. There was a weak association, as indicated by Cramer's V = 0.189, but there was a significant correlation between history and mass feature and the likelihood of developing malignant tumors compared to benign ones. Additionally, there was an insignificant correlation between signs and symptoms and diagnosis (p > 0.05). This finding is consistent with study done by Carvalho JP *et al.,*2020, whose found that age is a significant independent risk factor for ovarian cancer in the general population, with a sharp increase in incidence following menopause [11] and concurred with study done by Garg S *et al.,* 2017 whose found that cancer was more prevalent in the age bracket of six to eight decades.[12].

The study underscores that ultrasonography, remains a reliable modality for the detection and assessment of ovarian tumors. The significant associations between specific ultrasound features and both age and malignancy support the inclusion of these features in diagnostic algorithms P-Value less than 0.05 in Table 4-7. Moreover, the weak but notable association between previous breast cancer and ovarian malignancy suggests that patients with personal cancer histories should undergo diligent evaluation, as outlined in a study done by Carvalho JP *et al.,*2020. [12].

CONCLUSION

To identify adnexal masses, evaluate the diagnostic effectiveness of ultrasound, and correlate imaging results with patient demographics, symptoms, and history, the study effectively assessed ovarian tumors utilizing ultrasonography. The findings showed that the majority of lesions (68.8%) were benign, whereas 22% of cases were malignant and 9.3% were inconclusive. Ultrasound characteristics such as multilocular cysts without solid areas, uneven contours, ascites, many papillary projections, large solid areas, and high vascularity were substantially linked to malignancy.

According to age analysis, younger symptomatic women were more likely to present with specific benign traits, whereas older patients tended to have characteristics suggestive of malignancy. Notably, ovarian cancer and prior breast cancer history were found to be significantly correlated, highlighting the significance of a thorough patient history in risk assessment. The evaluated ultrasonography characteristics confirmed sonographic appearance in clinical practice by offering trustworthy markers for distinguishing benign from malignant tumors.

Overall, the results support the use of ultrasonography to improve diagnostic accuracy and guide care strategies for various patient profiles by confirming that it is a useful technique for the detection and assessment of ovarian tumors.

To increase the accuracy of their diagnosis and treatment choices, clinicians should take into account the patient's age, presenting symptoms, and medical history in addition to the ultrasound results. To maintain high diagnostic standards, sonographers and gynecologists should get regular training and updates on ultrasonography techniques. It is advised that future research employ a larger sample size and incorporate additional variables, such as the histopathological outcome.

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