Original Article

ISSN (0): 2347-338X; ISSN (P): 2347-3371

To Compare the Diagnostic Efficacy of Ultrasonography and Computed Tomography in The Assessment of Suspicious Ovarian Masses

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Abstract

Background: To compare the diagnostic efficacy of ultrasonography and computed tomography in the assessment of suspicious ovarian masses. **Subjects and Methods:** A total of 110 female participants were enrolled as subjects in this prospective study and carried out at Department of Radiology, Dhanalakshmi Srinivasan Medical College and Hospital. All patients underwent abdominal ultrasonography and computed tomography (CT) scan to determine the characteristics of the ovarian mass. This study excluded patients who had ovarian masses that could be managed conservatively. A comprehensive medical history pertaining to allergies and renal function tests was obtained prior to conducting the CT scan. In cases where a patient had a documented history of allergies, nonionic contrast agents were administered. **Results:** In the evaluation of benign and malignant ovarian masses, computed tomography (CT) demonstrated a sensitivity of 95.45%, specificity of 91.82%, and an accuracy of 93.64%. Additionally, the positive predictive value (PPV) and negative predictive value (NPV) were determined to be 94.55% and 90.91%, respectively. The sensitivity of ultrasonography (USG) in this study was found to be 90.91% for benign cases and 78.18% for malignant cases. The specificity of USG was determined to be 86.36% for benign cases and 77.27% for malignant cases. The positive predictive value (PPV) was calculated to be 88.18% for benign cases and 74.55% for malignant cases, while the negative predictive value (NPV) was 86.36% for benign cases and 72.73% for malignant cases. **Conclusion:** We concluded that the computed tomography (CT) has demonstrated a greater number of benefits in terms of tumor localization and characterization. Therefore, computed tomography (CT) may be recommended in cases where atypical abnormalities are detected during a routine ultrasound (USG) scan for the purpose of diagnosing ovarian masses.

Keywords: CT, USG, Suspicious Ovarian Masses, Benign, Malignant.

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Received: 31 January 2022 **Revised: 01 March 2022** **Accepted: 15 March 2022** **Published: 30 June 2022**

Introduction

Adnexal lesions, particularly ovarian masses, are frequently observed in women across various age groups and social strata. Due to the extensive range of diagnostic variations, these cases frequently present challenges for both medical practitioners and radiologists, causing confusion and uncertainty. While conservative treatment may be appropriate for docile benign ovarian lesions, aggressive neoplastic lesions typically necessitate radical surgical intervention and associated oncological therapy. Ovarian cancer is characterized by its late diagnosis and relatively low 5-year survival rate of 45%, rendering it a formidable threat to individuals' health. Endometrial cancer ranks second in terms of gynecological malignancies in India and exhibits a global prevalence.[1,2]

Ovarian cysts frequently manifest as asymptomatic entities characterized by the presence of a fluid-filled sac within the ovary. Occasionally, the manifestation of lower abdominal or back pain may be indicative of pelvic inflammatory disease. However, the majority of ovarian cysts are considered benign and do not pose a significant health risk.

Ovarian cysts can manifest as various types, which include follicular, corpus luteum, dermoid, and cystadenomas. The identification of ovarian cysts can be accomplished through the utilization of ultrasound imaging and various laboratory examinations. In certain cases, patients may be suggested medical intervention to relieve pain. In instances where cysts are of significant size, surgical interventions may be pursued. The majority of females of reproductive age have the potential to develop smaller cysts on a monthly basis. In a subset of women, specifically 8% of individuals, the presence of larger cysts may give rise to complications prior to the onset of menopause. Hence, the radiological assessment of ovarian masses plays a crucial role in the timely detection and characterization of lesions, enabling the differentiation between benign and malignant masses and ultimately guiding the appropriate therapeutic

intervention. Several diagnostic modalities, including ultrasound (USG), computed tomography (CT), and magnetic resonance imaging (MRI), have emerged as valuable tools for clinicians in resolving these diagnostic challenges. The ultrasonography (USG) is commonly the initial diagnostic procedure recommended for patients exhibiting clinical indications that may indicate the presence of an ovarian mass. One of the notable benefits of utilizing ultrasonography (USG) is its extensive accessibility, affordability, and precision in facilitating morphological characterization. Nevertheless, a significant proportion of ovarian masses may be classified as indeterminate when assessed using ultrasonography. Cross-sectional imaging techniques play a crucial role in diagnosing and evaluating such lesions. Magnetic resonance imaging (MRI) is capable of offering accurate anatomical localization and detailed lesion characterization, leading to a substantial reduction in the range of potential diagnoses. However, in the in rural areas of India the accessibility and cost efficiency of magnetic resonance imaging pose significant obstacles in establishing it as the secondary diagnostic modality for evaluating ovarian masses, following ultrasound. Contrastingly, computed tomography (CT) exhibits extensive accessibility, notable cost efficiency, swift imaging capabilities, and offers a broader visual perspective, enabling a comprehensive assessment of the abdominal region.[8-10]

Subjects and Methods

The present study, characterized as a prospective observational investigation, was conducted within the Department of Radiology. A total of 110 female participants were enrolled as subjects in this prospective study. All patients underwent abdominal ultrasonography and computed tomography (CT) scan to determine the characteristics of the ovarian mass. This study excluded patients who had ovarian masses that could be managed conservatively. The study excluded patients who were between the ages of 0 and 18 years, had mid-line uterine mass lesions detected through ultrasound (USG), were clinically and sonographically confirmed cases of ectopic pregnancy, and had sonographically confirmed benign cystic ovarian lesions such as functional cysts in patients of reproductive age group. A comprehensive medical history pertaining to allergies and renal function tests was obtained prior to conducting the CT scan. In cases where a patient had a documented history of allergies, nonionic contrast agents were administered.

Statistical Analysis

The collected data was entered into a computer program, specifically Microsoft Excel 2010, and subsequently exported to the data editor page of SPSS version 23, developed by SPSS Inc. in Chicago, Illinois, USA. The descriptive statistics encompassed the calculation of percentages, means, and standard deviations.

Results

Among the sample of 100 patients, the largest proportion of individuals fell within the age range of 45-55 years, accounting for 40 patients or 36.37% of the total. The next highest age group was 35-45 years, comprising 24 patients or 21.82%. Patients aged above 55 years constituted 21 individuals or 19.09% of the sample. The age range of 25-35 years accounted for 19 patients or 17.27%, while those below 25 years of age represented the smallest proportion with 6 patients or 5.45%. A total of 66 cases in the pre-menopausal stage and 44 cases in the postmenopausal stage were identified as having ovarian cysts. Among a total of 66 cases of pre-menopausal conditions, 14 cases were identified as malignant ovarian masses, while the remaining 52 cases were classified as benign. A total of 31 instances of malignant ovarian masses and 13 instances of benign ovarian masses were observed within the Postmenopausal group [Table 1,2].

Table 1: Age distribution of patients

Age Group (in years)	Number=110	Percentage (%)
Below 25	6	5.45
25-35	19	17.27
35-45	24	21.82
45-55	40	36.37
Above 55	21	19.09

Table 2: The characteristics of different ovarian masses

Category	Pre-menopausal	Post-menopausal	Total	Percentage
Malignant	14	31	45	40.91
Benign	52	13	65	59.09
Total	66	44	110	100

The most frequently observed presenting symptom was abdominal mass, accounting for 40.91% of cases. It is followed by pain abdomen of 25.45% and abdominal distension by 20%, others by pressure symptoms (9.09%), and loss of appetite (4.55%) [Table 3].

Table 3: Symptoms

Symptoms	Number	%
Loss of appetite	5	4.55
Pressure symptoms	10	9.09
Abdominal distension	22	20
Pain abdomen	28	25.45
Mass abdomen	45	40.91

Table 4: Benign and malignant tumors

Tumors	Number	%
Benign=65		
Mucinous cystadenoma	35	53.85
Cystadenoma	16	24.62
Dermoid	6	9.23
Fibro Thecoma	4	6.15
Fibroma	2	3.08
Granulose cell tumor	2	3.08
Malignant=45		
Papillary serous cystadeno carcinoma	15	33.33
Cystadeno carcinoma	10	22.22
Serous cystadeno carcinoma	7	15.56

Papillary mucinous cystadeno carcinomoa	3	6.67
Borderline Malignant Serous Mucinous	 2 4	 4.44 8.89
Endometroid carcinoma	1	2.22
Dysgerminoma	3	6.67

The most prevalent benign tumor is mucinous cystadenoma, accounting for 53.85% of cases, followed by serous cystadenoma at 24.62%. Other less common benign tumors include Dermoid (9.23%), Fibro Thecoma (6.15%), Fibroma (3.08%), and Granulose cell tumor (3.08%). The most prevalent malignant tumor is papillary serous cystadenocarcinoma, accounting for 33.33% of cases, followed by mucinous cystadenocarcinoma at 22.22%. Other types include serous cystadenocarcinoma (15.56%), papillary mucinous cystadenocarcinoma (6.67%), and borderline malignant tumors (4.44% for serous and 8.89% for mucinous). Less common types include endometrioid carcinoma (2.22%) and dysgerminoma (6.67%) [Table 4].

Table 5: Comparison between USG and CT in diagnosis of ovarian masses

Category	CT Study		USG Study	
	Benign	Malignant	Benign	Malignant
Sensitivity	95.45%	85.45%	90.91%	78.18%
Specificity	91.82%	86.36%	86.36%	77.27%
Positive Predictive Value	94.55%	90.91%	88.18%	74.55%
Negative Predictive value	90.91%	83.64%	86.36%	72.73%

In the evaluation of benign and malignant ovarian masses, computed tomography (CT) demonstrated a sensitivity of 95.45%, specificity of 91.82%, and an accuracy of 93.64%. Additionally, the positive predictive value (PPV) and negative predictive value (NPV) were determined to be 94.55% and 90.91%, respectively. The sensitivity of ultrasonography (USG) in this study was found to be 90.91% for benign cases and 78.18% for malignant cases. The specificity of USG was determined to be 86.36% for benign cases and 77.27% for malignant cases. The positive predictive value (PPV) was calculated to be 88.18% for benign cases and 74.55% for malignant cases, while the negative predictive value (NPV) was 86.36% for benign cases and 72.73% for malignant cases [Table 5].

Discussion

Ovarian tumors pose a significant clinical challenge among all gynecological cancers and ovarian malignancies. Carcinoma ranks as the second most prevalent form of gynaecological carcinoma in terms of incidence. Given that the majority of ovarian tumors are detected in advanced stages, relying solely on clinical diagnosis can be challenging. Since benign ovarian tumors are much more common than malignant ones, accurately assessing the likelihood of malignancy is crucial. This determination heavily relies on various imaging techniques.

Ultrasound and computed tomography (CT) are integral components in the diagnostic process, preoperative staging, and assessment of tumor recurrence in cases of ovarian carcinoma. Ovarian carcinoma exhibits distinct tumor morphologies and patterns of tumor dissemination within the peritoneal cavity. Through the identification and acknowledgement of these distinctive characteristics, the radiologist is able to provide valuable support to the clinicians in the formulation of treatment strategies. The determination of malignancy in ovarian tumors is of utmost importance, given the significantly higher prevalence of benign tumors compared to malignant ones. This determination heavily relies on the utilization of various imaging modalities. Based on a limited number of studies conducted, it has been suggested that ultrasound represents a highly effective approach for preoperative screening. This modality is considered the most feasible option currently accessible and demonstrates a substantial negative predictive value in the identification of ovarian tumors.[11,12] When the presence of an ovarian mass is identified, there are two primary concerns that arise: the initial task is to ascertain whether the mass is benign or malignant, and subsequently, if it is determined to be malignant, the subsequent objective is to assess the scope and severity of the disease. If the characteristics of the mass are sufficiently identified in the image, it can prevent the patient from undergoing unnecessary surgery that incur additional costs.[12] Moreover, when staging is performed with precision on imaging, it not only proves to be cost-effective but also facilitates subsequent planning. Nevertheless, it is acknowledged that surgery plays a crucial role in providing a definitive diagnosis and further characterizing masses. The diagnostic efficacy of staging and pelvic examination conducted by gynecologists, as well as the utility of serum CA-125 levels in diagnosing pelvic masses, are occasionally underestimated by the USG. Moreover, it is worth noting that the sensitivity of these diagnostic methods frequently falls below 50%. The studies conducted by Boseti C and Onyeka et al had demonstrated that the sensitivity of morphologic analysis utilizing ultrasound in the prediction of malignancy in ovarian tumors ranges from 85% to 97%, while its specificity varies between 56% and 95%.[13,14]

Previous studies have demonstrated that the sensitivity of morphologic analysis using ultrasound for predicting malignancy in ovarian tumors ranges from 85% to 97%, while its specificity ranges from 56% to 95%.[15-17]

The aforementioned data demonstrates a higher level of sensitivity in detecting abnormal ovarian masses within the current population. Ovarian tumors pose a significant clinical challenge among gynecological cancers, with ovarian carcinoma ranking as the second most prevalent gynecological carcinoma in terms of occurrence. Due to the prevalence of advanced-stage cases, the clinical diagnosis of ovarian tumors is challenging. Given the significant predominance of benign tumors over malignant ones, it is crucial to establish a level of suspicion for malignancy, which heavily relies on various imaging techniques. The assessment of the level of suspicion for malignancy in an ovarian mass is a crucial aspect of its management, as the choice between radical surgery and conservative surgery

relies on an accurate preoperative diagnosis.[16]

The clinical assessment of factors such as site (unilateral or bilateral), fixity, consistency, presence of nodules in Douglas pouch, and presence of ascites can contribute to an increased suspicion of malignancy to a certain degree. However, when these factors are combined with other diagnostic tools such as tumor markers and two-dimensional ultrasounds, the sensitivity for detecting malignancy is further enhanced. Computed tomography (CT) can be employed as a diagnostic tool to evaluate the extent or severity of ovarian disorders in female patients. Insufficient evidence exists to support the notion that computed tomography (CT) is notably more specific and sensitive in the detection of ovarian cancer, as ultrasound (USG) is deemed adequate for evaluating simple ovarian cysts. Jeong et al. (2018) demonstrated that certain morphological characteristics were strongly indicative of malignancy. These characteristics included the presence of a solid component (63% probability), papillary projection (92% probability), and free fluid in the peritoneal cavity (56% probability).[17] In a study conducted by Onyeka et al., it was observed that the sensitivity of CT scan in detecting ovarian cancer was higher compared to ultrasound (83% vs. 67%). However, ultrasound exhibited greater specificity in this regard.[14] In the present investigation, In the context of distinguishing between benign and malignant ovarian masses, computed tomography (CT) demonstrated a sensitivity of 95.45%, specificity of 91.82%, and an accuracy of 93.64%. Additionally, the positive predictive value (PPV) and negative predictive value (NPV) were determined to be 94.55% and 90.91%, respectively. The sensitivity of ultrasonography (USG) was found to be 90.91% and 78.18% for benign and malignant cases, respectively. The specificity of USG was determined to be 86.36% and 77.27% for benign and malignant cases, respectively. The positive predictive value (PPV) and negative predictive value (NPV) were calculated to be 88.18% and 74.55% for benign cases, and 86.36% and 72.73% for malignant cases, respectively. The results of this study align with the findings of Ahmed A et al.[19], which reported a sensitivity of 78% and specificity of 88.8% for Trans-Abdominal-Sonography (TAS), and a sensitivity of 91% and specificity of 81.4% for CT in assessing the benign or malignant nature of adnexal masses. Although we have reservations about the findings of the ultrasonography (USG) study conducted by Behtash et al.[20], which reported a sensitivity of 91.2% and specificity of 68.3%, our own study's computed tomography [CT] results exhibit a notable resemblance to theirs. Specifically, our study demonstrates a sensitivity of 85.3% and specificity of 56.1%, which closely aligns with their findings. In their study on the diagnostic accuracy of various techniques for diagnosing ovarian tumors in premenopausal women, Verit FF et al.[21] reported that ultrasonography (USG) demonstrated a sensitivity of 83% and specificity of 92%, while computed tomography (CT) exhibited a sensitivity of 91% and specificity of 96%.

In a meta-analysis conducted by Kinkel et al.[8], it was reported that computed tomography (CT) demonstrated a sensitivity of 81% and specificity of 87% when utilized for the evaluation of indeterminate masses observed on ultrasonography (USG). In the studies conducted by Gatreh-Samani F et al.[22], Mubarak F et al.[23], Tsili AC et al.[24], and Zhang J et al.[25], CT demonstrated a higher sensitivity and lower specificity in distinguishing between benign and malignant ovarian masses. This disparity in results may be attributed to the larger sample sizes utilized in these studies. However, Liu Y et al.[5] reported lower sensitivity and higher specificity compared to our current study.

Conclusion

The current study revealed notable disparities between the two methods, namely ultrasound (USG) and computed tomography (CT). Computed tomography (CT) has demonstrated a greater number of benefits in terms of tumor localization and characterization. Therefore, computed tomography (CT) may be recommended in cases where atypical abnormalities are detected during a routine ultrasound (USG) scan for the purpose of diagnosing ovarian masses.

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How to cite this article: Reddy BC, Reddy VK. To compare the diagnostic efficacy of ultrasonography and computed tomography in the assessment of suspicious ovarian masses. Asian J. Med. Radiol. Res. 2022;10(1):96-100.

DOI: dx.doi.org/10.47009/ajmrr.2022.10.1.17

Source of Support: Nil, Conflict of Interest: None declared.