e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com doi: 10.25258/ijpqa.16.12.175

International Journal of Pharmaceutical Quality Assurance 2025; 16(12); 1128-1133

Original Research Article

Diagnostic Accuracy of Ultrasonography versus Computed Tomography in Characterizing Ovarian Masses: A Comparative Study

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Received: 25-09-2025 / Revised: 23-10-2025 / Accepted: 26-11-2025

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Conflict of interest: Nil

Abstract:

Background: Ovarian masses are frequently encountered in gynecologic practice and present a diagnostic challenge due to their wide morphological spectrum and potential for malignancy. Accurate preoperative characterization of these masses is essential for surgical planning, fertility preservation, and risk stratification. While ultrasonography (USG) is often the first-line imaging modality owing to its accessibility and safety, computed tomography (CT) is increasingly used for further characterization and staging. Comparative studies evaluating the diagnostic accuracy of both modalities in the same patient cohort are limited, particularly in resource-limited settings like Bihar.

Objectives:

- To compare the diagnostic efficacy of ultrasonography and computed tomography in evaluating suspicious ovarian masses.
- To assess the ability of each modality in differentiating benign from malignant lesions based on radiologic features.
- To correlate imaging findings with final histopathological diagnosis wherever available.

Materials and Methods: This was a prospective observational study conducted in the Department of Radiodiagnosis at RDJM Medical College and Hospital, Muzaffarpur, Bihar. A total of 60 female patients presenting with clinically and/or sonographically suspicious adnexal masses were enrolled over a 12-month period. All patients underwent transabdominal or transvaginal USG followed by contrast-enhanced CT. Radiological features including size, septation, solid components, papillary projections, ascites, and lymphadenopathy were documented. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy of USG and CT were calculated using histopathology or clinical follow-up as the reference standard.

Results: Out of 60 cases, 36 were diagnosed as benign and 24 as malignant on final diagnosis. Ultrasonography correctly identified 31 benign and 18 malignant lesions, while CT identified 33 benign and 22 malignant lesions. CT demonstrated superior diagnostic performance with an overall accuracy of 91.6% compared to 81.6% for USG. CT was particularly more effective in evaluating complex lesions, ascites, and lymph node involvement. However, USG remained superior in evaluating cystic characteristics and was more accessible for initial screening.

Conclusion: While ultrasonography remains the preferred initial modality due to its non-invasive and cost-effective nature, CT provides higher diagnostic accuracy, especially in complex or indeterminate ovarian lesions. A combined approach utilizing USG for preliminary assessment and CT for comprehensive evaluation may optimize diagnostic precision in suspicious ovarian masses.

Keywords: Ovarian mass, ultrasonography, computed tomography, benign, malignant, adnexal lesion, diagnostic accuracy.

Introduction

Ovarian masses represent a broad spectrum of pathologies ranging from functional cysts to overt malignancies. These adnexal lesions are frequently encountered during routine gynecological examinations and imaging evaluations [1]. Given the significant implications for fertility, hormonal

function, and oncological outcomes, accurate preoperative characterization is crucial in distinguishing benign from malignant pathology and planning appropriate surgical or medical management [2].

Ultrasonography (USG), particularly transvaginal sonography (TVS), is the first-line imaging modality for evaluating adnexal masses due to its wide availability, affordability, non-invasiveness, and absence of ionizing radiation. It offers excellent spatial resolution for detecting cystic and solid components, septations, papillary projections, and vascular flow patterns through Doppler studies [3]. Several scoring systems and criteria including the IOTA (International Ovarian Tumor Analysis) rules have been developed to enhance diagnostic reliability using USG features. However, ultrasonography is inherently operator-dependent and may be limited by patient body habitus or obscured anatomy due to bowel gas or large lesion size [4]. Computed tomography (CT), especially contrast-enhanced CT, plays a vital role in the further characterization of ovarian masses, particularly when USG findings are equivocal or when malignancy is suspected. CT offers superior field-of-view, better tissue contrast resolution, and multiplanar reformatting capabilities, making it valuable for assessing the extent of disease, lymphadenopathy, peritoneal deposits, ascites, and distant metastasis. It is commonly employed in staging ovarian malignancies and guiding surgical or oncological decision-making [5,6].

Despite their widespread use, comparative studies of USG and CT evaluating the same cohort of patients with suspicious ovarian masses are relatively scarce in the Indian context, particularly in resource-constrained regions like Bihar. Understanding the respective strengths and limitations of these modalities is essential to formulate an efficient diagnostic workflow that minimizes unnecessary interventions while ensuring timely and accurate diagnosis.

The current study aims to systematically compare the diagnostic accuracy of ultrasonography and computed tomography in the evaluation of suspicious ovarian masses, using histopathological or clinical follow-up as the gold standard. The results are intended to provide a region-specific evidence base to optimize imaging protocols and improve patient outcomes in gynecologic oncology.

Objectives: This study was conducted with the aim of evaluating and comparing the diagnostic utility of ultrasonography (USG) and computed tomography (CT) in characterizing suspicious ovarian masses.

Primary Objectives:

1. To assess the diagnostic accuracy of ultrasonography and contrast-enhanced CT in differentiating benign from malignant ovarian masses.
2. To evaluate the radiological features of ovarian masses such as size, morphology, septations, solid components, papillary projections, ascites, and lymphadenopathy using USG and CT.

Secondary Objectives:

1. To compare the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy of USG and CT against final histopathological diagnosis or clinical follow-up.
2. To identify the strengths and limitations of each imaging modality in specific lesion characteristics.
3. To propose an optimized imaging protocol for effective diagnosis and preoperative assessment of ovarian masses in resource-limited settings.

Materials and Methods

Study Design and Setting: This was a prospective, observational, comparative study conducted in the Department of Radiodiagnosis, RDJM Medical College and Hospital, Turki, Muzaffarpur, Bihar.

Study Duration: The study was carried out over a 12-months

Sample Size: A total of 60 female patients with clinically or sonographically suspicious ovarian masses were enrolled in the study using a purposive sampling technique.

Inclusion Criteria:

- Female patients aged between 18 and 65 years.
- Patients presenting with adnexal masses that appeared suspicious for neoplastic pathology on initial evaluation.
- Patients who underwent both ultrasonography and contrast-enhanced computed tomography (CECT).
- Availability of histopathological diagnosis or clinical follow-up for confirmation.

Exclusion Criteria:

- Pregnant patients.
- Patients with previously diagnosed gynecological malignancies.
- Patients who did not complete both imaging modalities.
- Non-ovarian pelvic masses or inconclusive clinical follow-up.

Imaging Protocols:

1. Ultrasonography (USG):

- Performed using a high-resolution trans-abdominal and transvaginal probe.
- Assessed features included: lesion size, wall thickness, internal septations, echogenicity, solid/cystic components, papillary projections, ascites, and Doppler flow.

2. Contrast-Enhanced Computed Tomography (CECT):

- Scans were obtained in axial and coronal planes using a multidetector CT scanner.
- Parameters analyzed included: lesion mor-phology, contrast enhancement, mural nodules, calcifications, lymphadenopathy, ascites, and peritoneal deposits.

Reference Standard: Final diagnosis was based on histopathology following surgical excision. In patients not undergoing surgery, clinical and radiologic follow-up for at least 3 months was used to determine benign/malignant status.

Data Analysis: All data were entered in Microsoft Excel and analyzed using SPSS version 26.0. Diagnostic accuracy parameters—sensitivity, specificity, PPV, NPV, and accuracy—were calculated for both USG and CT using standard formulas. Comparative statistics were applied using Chi-square and McNemar's test where applicable. A p-value <0.05 was considered statistically significant.

Results

The present prospective observational study included 60 female patients presenting with clinically or sonographically suspicious ovarian masses. Each patient underwent both ultrasonography and contrast-enhanced computed tomography (CECT), and their imaging findings were compared with histopathological or clinical follow-up data to determine diagnostic accuracy. The patients ranged from 18 to 65 years in age, and most presented with pelvic pain, menstrual irregularities, or abdominal distension. Imaging features including lesion size, morphology, internal architecture, and associated findings such as ascites or lymphadenopathy were analyzed in both modalities to differentiate benign from malignant lesions. A total of 36 cases were confirmed to be benign and 24 cases malignant on final diagnosis.

Table 1: Age-wise distribution of patients

Age group (years)	Number of patients	Percentage (%)
18–30	7	11.7
31–40	17	28.3
41–50	24	40.0
51–65	12	20.0

Table 1 shows that the majority of patients (40%) were in the age group of 41–50 years, followed by 31–40 years (28.3%).

Table 2: Clinical symptoms at presentation

Symptom	Frequency	Percentage (%)
Lower abdominal pain	42	70.0
Menstrual irregularities	29	48.3
Abdominal distension	18	30.0
Loss of appetite/weight	7	11.7

Table 2 reveals that lower abdominal pain was the most common complaint (70%), followed by menstrual irregularities (48.3%).

Table 3: Final diagnosis based on histopathology/follow-up

Final diagnosis	Number of cases	Percentage (%)
Benign	36	60.0
Malignant	24	40.0

Table 3 indicates that 36 cases (60%) were benign, while 24 cases (40%) were malignant.

Table 4: Ultrasonographic diagnosis compared to final diagnosis

USG finding	Benign (confirmed)	Malignant (confirmed)
Diagnosed as benign	31	6
Diagnosed as malignant	5	18

Table 4 shows that USG correctly identified 31 out of 36 benign and 18 out of 24 malignant cases.

Table 5: CT diagnosis compared to final diagnosis

CT finding	Benign (confirmed)	Malignant (confirmed)
Diagnosed as benign	33	2
Diagnosed as malignant	3	22

Table 5 highlights CT's performance, correctly diagnosing 33 benign and 22 malignant cases.

Table 6: Diagnostic performance of USG

Parameter	Value (%)
Sensitivity	75.0
Specificity	86.1
Positive Predictive Value	78.2
Negative Predictive Value	83.7
Overall Accuracy	81.6

Table 6 presents sensitivity, specificity, PPV, NPV, and accuracy for ultrasonography.

Table 7: Diagnostic performance of CT

Parameter	Value (%)
Sensitivity	91.6
Specificity	91.6
Positive Predictive Value	88.0
Negative Predictive Value	94.2
Overall Accuracy	91.6

Table 7 shows higher values across all diagnostic parameters for CT.

Table 8: Common sonographic features in malignant lesions

Feature	Frequency	Percentage (%)
Solid components	21	87.5
Papillary projections	18	75.0
Thick septations	15	62.5
Ascites	12	50.0

Table 8 highlights key features frequently noted in malignant lesions on USG.

Table 9: CT features suggestive of malignancy

Feature	Frequency	Percentage (%)
Heterogeneous enhancement	20	83.3
Peritoneal deposits	15	62.5
Ascites	18	75.0
Lymphadenopathy	11	45.8

Table 9 presents typical CT findings observed in confirmed malignant cases.

Table 10: Comparative modality performance (McNemar's test)

Modality	Correct Diagnosis	Incorrect Diagnosis	p-value
USG	49	11	0.031
CT	55	5	

Table 10 statistically compares the performance of USG and CT using McNemar's test, indicating significant superiority of CT ($p < 0.05$).

Table 1, most patients fell within the 41–50 years age group, which is consistent with peak ovarian pathology presentation. Table 2 shows that lower abdominal pain and menstrual irregularities were the most frequent presenting complaints. Table 3 confirms that 60% of lesions were benign. Table 4 and Table 5 reveal that CT outperformed USG in accurately classifying lesions.

Table 6 and Table 7 summarize that CT achieved higher sensitivity and accuracy (91.6%) compared to USG (81.6%). Table 8 and Table 9 present the radiologic features most associated with malignancy in both modalities, such as solid areas, papillary projections, ascites, and lymphadenopathy. Table 10 confirms via statistical testing that CT was significantly more accurate than USG in evaluating ovarian masses.

Discussion

The diagnostic evaluation of ovarian masses plays a pivotal role in determining the clinical pathway

for affected women, especially when malignancy is suspected. Early differentiation between benign and malignant lesions significantly improves surgical planning, prognosis, and patient outcomes. In this context, imaging modalities such as ultrasonography (USG) and computed tomography (CT) remain essential tools in the preoperative workup [7,8].

Ultrasonography, particularly transvaginal USG, continues to be the first-line imaging modality due to its widespread availability, affordability, and absence of ionizing radiation. It is especially useful for characterizing cystic components, detecting septations, papillary projections, and assessing vascularity using Doppler techniques [9]. However, it has certain limitations, particularly in obese patients, those with large pelvic masses extending beyond the field of view, and in distinguishing complex or borderline tumors. Moreover, its diagnostic accuracy is highly operator-dependent, leading to variable interpretation [10].

CT imaging, especially with contrast enhancement, overcomes many of these limitations and provides comprehensive evaluation of the lesion's extent, internal architecture, and involvement of adjacent structures. Its ability to detect peritoneal deposits, lymphadenopathy, and distant metastases makes it invaluable in preoperative staging of ovarian cancers [11]. In this study, CT demonstrated significantly higher sensitivity and overall accuracy in comparison to USG, corroborating with findings from previous international studies.

It was particularly more reliable in detecting malignant features such as peritoneal carcinomatosis, solid-enhancing components, and ascitic fluid [12]. While USG showed high specificity and reasonable sensitivity in identifying benign lesions, it underperformed in cases with complex solid-cystic architecture or lesions obscured by bowel gas. In contrast, CT more accurately identified malignant features and correctly classified borderline cases that were misinterpreted on USG. This supports the clinical practice of using USG as the initial screening tool and reserving CT for further evaluation of suspicious or indeterminate cases [13,14].

The importance of correlating radiological findings with histopathological results cannot be overstated, as this remains the gold standard for definitive diagnosis. In cases where histopathology was not available, clinical and radiologic follow-up served as an acceptable alternative to validate imaging interpretation [15]. This study emphasizes the complementary roles of USG and CT in the diagnostic algorithm for ovarian masses. A combined approach maximizes diagnostic yield, particularly in settings where clinical suspicion is high and lesion complexity warrants advanced imaging. Regional data, such as provided in this study from Bihar, are essential to guide imaging strategies tailored to local resource availability and patient population characteristics.

Conclusion

This study highlights the significant diagnostic value of both ultrasonography and computed tomography in the evaluation of suspicious ovarian masses. While USG remains a highly effective and accessible initial imaging modality, especially for assessing cystic characteristics, CT provides superior diagnostic accuracy, particularly in complex and malignant lesions. CT's enhanced capability to evaluate solid components, peritoneal spread, and lymphadenopathy makes it indispensable for comprehensive staging and surgical planning. A combined approach using USG for preliminary screening and CT for advanced assessment can improve diagnostic precision, reduce misclassification, and ensure better patient management, particularly in resource-limited settings like Bihar.

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