

Diagnostic Accuracy Of Computed Tomography In Characterization Of Adnexal Masses: A Prospective Study

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Abstract

Background: Adnexal masses encompass a broad spectrum of gynecological conditions, ranging from simple benign cysts to highly aggressive malignant tumors, and they continue to represent a significant diagnostic challenge in clinical practice. Precise identification and characterization of these lesions are crucial for selecting appropriate management strategies, minimizing unnecessary surgical procedures, and improving overall patient outcomes. Although ultrasonography is commonly used as the first-line imaging modality, its limitations in assessing complex or indeterminate lesions often require the use of advanced imaging techniques such as computed tomography (CT).

Objective: This study was undertaken to assess the diagnostic utility and accuracy of CT in the evaluation of adnexal masses, with particular focus on differentiating benign lesions from malignant ones.

Methods: In this prospective study, patients presenting with clinically suspected or sonographically detected adnexal masses were included. All participants underwent contrast-enhanced CT scanning. Imaging findings were systematically evaluated based on lesion morphology, attenuation characteristics, enhancement patterns, presence of septations, solid components, calcifications, and associated features such as ascites, lymphadenopathy, and peritoneal deposits. These imaging findings were subsequently correlated with histopathological examination, which was considered the definitive standard for diagnosis.

Results: CT imaging demonstrated excellent diagnostic capability in the assessment of adnexal masses, showing high sensitivity, specificity, and overall accuracy in distinguishing benign from malignant lesions. Imaging features such as irregular margins, thick septations, enhancing solid areas, and evidence of local or distant dissemination were strongly indicative of malignancy. In contrast, lesions that appeared well-defined, thin-walled, and predominantly cystic were generally benign. A strong concordance was observed between CT findings and histopathological diagnoses, underscoring the reliability of CT imaging.

Conclusion: Computed tomography is a highly reliable imaging modality for the characterization and preoperative evaluation of adnexal masses. It provides comprehensive anatomical and pathological information that supports accurate diagnosis, staging, and treatment planning, especially in complex cases. Incorporating CT into diagnostic protocols can significantly improve clinical decision-making and enhance patient care.

Keywords: Adnexal mass, computed tomography, ovarian tumors, histopathology, diagnostic accuracy, pelvic imaging

Date of Submission: 06-04-2026

Date of Acceptance: 16-04-2026

I. Introduction

Adnexal masses constitute a heterogeneous group of lesions arising from the ovaries, fallopian tubes, or adjacent pelvic structures, encompassing a wide pathological range from benign functional cysts to highly aggressive malignancies. These lesions are frequently encountered in clinical practice and present a considerable diagnostic challenge due to overlapping clinical manifestations and imaging appearances. While many adnexal masses are detected incidentally, some patients may present with vague and nonspecific symptoms such as abdominal pain, distension, or menstrual irregularities, often resulting in delayed diagnosis. Therefore, the ability to accurately distinguish between benign and malignant lesions is essential, as it directly influences therapeutic strategies, surgical planning, and patient prognosis.[1,2]

Ovarian malignancies, in particular, remain a leading cause of mortality among gynecological cancers, largely due to late-stage presentation and lack of specific symptoms. Early and accurate identification of adnexal lesions is therefore critical for improving clinical outcomes, enabling timely intervention, and avoiding unnecessary surgical procedures in benign conditions. However, clinical assessment alone is insufficient, necessitating the use of imaging modalities to enhance diagnostic accuracy.[3]

Imaging plays a central role in the evaluation and risk stratification of adnexal masses. Ultrasonography is widely accepted as the initial imaging technique because of its accessibility and ability to provide real-time evaluation. However, it has limitations in the characterization of complex or indeterminate lesions, which often necessitates the use of advanced cross-sectional imaging modalities. In this context, standardized reporting systems and imaging guidelines developed by international radiological organizations have emphasized the importance of structured evaluation and risk assessment of adnexal lesions.[4]

Computed tomography (CT) has emerged as a vital imaging modality in the comprehensive evaluation of adnexal masses, particularly in cases where malignancy is suspected. CT allows detailed assessment of lesion morphology, including the presence of solid and cystic components, septations, calcifications, fat content, and contrast enhancement patterns. More importantly, CT plays a crucial role in identifying extra-ovarian spread of disease, including peritoneal carcinomatosis, omental deposits, lymphadenopathy, and distant metastases, all of which are essential for accurate staging and prognostication.[5,6]

Recent evidence-based guidelines and expert consensus recommendations advocate the use of CT as the preferred modality for staging suspected ovarian malignancies and for guiding treatment planning, including evaluation of operability and feasibility of cytoreductive surgery [1]. Furthermore, contemporary diagnostic pathways highlight the importance of CT in the assessment of complex or high-risk adnexal lesions, reinforcing its relevance in modern oncologic imaging. Advances in imaging standardization, including the development of CT-based reporting systems and integration into multidisciplinary decision-making processes, have further improved the diagnostic consistency and reproducibility of CT findings in adnexal pathology.[3,4]

Despite these advancements, there remains a relative scarcity of studies focusing exclusively on the diagnostic performance of CT in adnexal masses with direct correlation to histopathological findings. Most available literature emphasizes combined imaging approaches, which limits the understanding of CT as an independent diagnostic tool. Given that histopathology remains the gold standard for definitive diagnosis, correlating CT findings with pathological outcomes is essential to validate its diagnostic accuracy and clinical applicability.[7]

Accordingly, the present study aims to evaluate the role of CT imaging in the characterization of adnexal masses and to correlate imaging findings with histopathological results. This study seeks to contribute to the existing literature by providing a focused evaluation of CT, thereby enhancing diagnostic precision, improving preoperative assessment, and supporting evidence-based clinical decision-making.

The primary aim of the present study is to evaluate the diagnostic role and clinical utility of computed tomography (CT) in the assessment of adnexal masses, with particular emphasis on accurate lesion characterization and preoperative differentiation between benign and malignant pathologies.

To achieve this aim, the study seeks to systematically characterize adnexal lesions based on their CT imaging features, including morphology, internal architecture, enhancement patterns, and associated findings such as ascites, lymphadenopathy, and peritoneal involvement. Furthermore, an attempt is made to differentiate benign from malignant adnexal masses using established CT criteria. The study also aims to correlate CT imaging findings with histopathological diagnoses, which serve as the gold standard, in order to validate the accuracy of imaging interpretations. In addition, the diagnostic performance of CT was assessed by calculating key statistical parameters, including sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV), thereby determining its effectiveness as a reliable diagnostic tool in the assessment of adnexal masses.

II. Materials And Methods

This study was designed as a prospective observational investigation and was carried out in the Department of Radiodiagnosis at a tertiary care center over a specified duration. The study cohort consisted of patients who were clinically suspected of having adnexal masses and were referred for detailed radiological assessment. All patients who met the eligibility criteria and underwent computed tomography (CT) as part of their diagnostic evaluation were considered for inclusion in the study.

Inclusion criteria comprised patients who underwent contrast-enhanced computed tomography (CECT) of the abdomen and pelvis for the assessment of suspected adnexal lesions and subsequently received histopathological confirmation of the diagnosis. Patients were excluded if their CT imaging data were incomplete or of suboptimal quality, or if histopathological confirmation was not available due to lack of evaluation or loss to follow-up.

All CT scans were performed following a uniform and standardized imaging protocol. Contrast-enhanced scans of the abdomen and pelvis were obtained after intravenous administration of iodinated contrast agents, with images acquired during appropriate phases to allow optimal visualization and characterization of the lesions. The CT images were systematically analyzed for multiple parameters, including lesion size, anatomical location, and morphological features such as cystic, solid, or mixed composition. Additional characteristics assessed included wall thickness, presence of septations, papillary projections, and calcifications.

Associated findings such as ascites, lymph node enlargement, peritoneal deposits, and omental involvement were also carefully evaluated to determine the extent of disease spread.

Based on the observed imaging characteristics, adnexal masses were classified as benign or malignant according to predefined radiological criteria. Lesions exhibiting features such as thin walls, a unilocular cystic appearance, absence of solid components, and no signs of invasion were considered indicative of benign pathology. In contrast, lesions demonstrating irregular or thickened walls, complex or solid components, papillary projections, areas of necrosis, and evidence of local invasion or distant dissemination were categorized as suspicious for malignancy.

Histopathological analysis of surgical specimens or biopsy samples was regarded as the reference standard for establishing the final diagnosis. The imaging findings obtained from CT were subsequently compared with histopathological results to assess the accuracy and reliability of CT interpretation.

Statistical evaluation was performed to determine the diagnostic performance of CT in differentiating benign from malignant adnexal masses. Important parameters such as sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy were calculated using established statistical methods.

III. Results

Demographic profile

In the present study, a total of 100 patients with clinically suspected adnexal masses were assessed. The majority of patients were within the reproductive age group, with the highest number of cases observed in the 21–30 years age bracket, followed by those aged 31–40 years. A comparatively smaller number of cases occurred in postmenopausal women; however, this group demonstrated a relatively higher probability of malignancy. Most of the adnexal lesions were unilateral, accounting for 84% of cases, whereas bilateral involvement was identified in 16% of patients, **Table 1**.

Table 1: Age Distribution of Patients with Adnexal Masses

AGE GROUP	NUMBER OF PATIENTS	PERCENTAGE
<20	8	8
21–30	27	27
31–40	20	20
41–50	16	16
51–60	14	14
61–70	9	9
>70	6	6
TOTAL	100	100

Spectrum of lesions

Histopathological evaluation revealed that 72% of the adnexal masses were benign in nature, while the remaining 28% were malignant. Among the benign lesions, serous cystadenoma was the most frequently encountered type, accounting for 22% of cases. This was followed by mucinous cystadenoma (12%), hemorrhagic cysts (10%), mature cystic teratoma (8%), and endometrioma (6%). Other benign pathologies identified included fibroma, Brenner tumor, corpus luteum cyst, simple cysts, and tubo-ovarian abscess.

With respect to malignant lesions, serous cystadenocarcinoma was the most common subtype, comprising 18% of cases. Mucinous cystadenocarcinoma was the next most frequent, accounting for 8%, while a few cases of clear cell carcinoma and dysgerminoma were also observed, **Figure 1**.

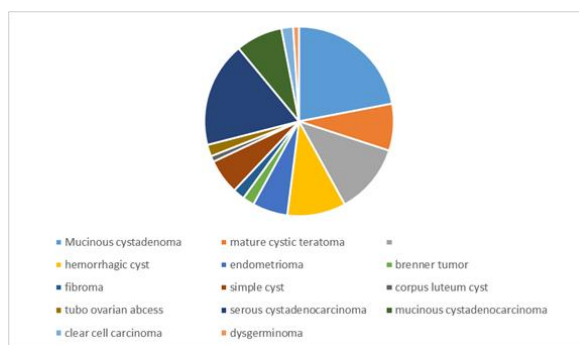


Figure 1: Distribution of the lesions as per histopathological diagnosis

CT imaging features

CT imaging revealed a diverse array of morphological features that were valuable for lesion evaluation. Approximately 18% of cases displayed solid or solid-cystic components, while the presence of nodularity and enhancing soft tissue elements was more commonly observed in malignant lesions. Septations were noted in a considerable proportion of cases, with thick septations (>3 mm) observed in 26% of lesions, which were more strongly correlated with malignancy. Ascites was identified in a subset of patients, with a higher prevalence in those with malignant lesions. Lymphadenopathy was present in about 12% of cases, often suggesting advanced disease. Additional findings such as peritoneal deposits (8%) and calcifications (15%) provided further insights into lesion characterization, **Table 2**.

Table 2: CT Imaging Characteristics of Adnexal Masses

CT Feature	Number of Cases	Percentage (%)
Cystic lesions	68	68
Solid-cystic lesions	27	27
Solid lesions	5	5
Nodules present	23	23
Septal thickening present	45	45
Ascites present	13	13
Calcifications	15	15
Lymphadenopathy	12	12
Peritoneal deposits	14	14

CT diagnosis vs histopathology

The classification of adnexal masses based on CT imaging showed a strong correlation with histopathological results. Lesions identified as benign on CT imaging predominantly corresponded with benign histological findings, typically characterized by features such as unilocular cysts, thin walls, and the absence of solid enhancing components. In contrast, lesions identified as malignant on CT exhibited irregular margins, solid components, papillary projections, and signs of extra-ovarian spread, which were confirmed by histopathological analysis.

The observed correlation between CT diagnoses and histopathological outcomes underscores the reliability of CT imaging in preoperative evaluations. Detailed correlation tables are provided to illustrate the agreement between CT findings and histopathological diagnoses, **Table 3**.

Table 3: CT Diagnosis vs Histopathology (Gold Standard)

CT Diagnosis	Histopathology Malignant (+)	Histopathology Benign (-)	Total
Malignant	24	2	26
Benign	4	70	74
Total	28	72	100

Diagnostic performance:

CT imaging exhibited outstanding diagnostic performance in distinguishing between benign and malignant adnexal masses. The sensitivity for detecting malignancy was 92.85%, with a specificity of 97.22%. The positive predictive value (PPV) and negative predictive value (NPV) were both 92.85% and 97.22%, respectively. The overall diagnostic accuracy of CT was found to be high, highlighting its reliability as a robust imaging modality for the evaluation and characterization of adnexal lesions, **Table 4**.

Table 4: Diagnostic Performance of CT

Parameter	Value
Sensitivity	92.30
Specificity	97.22
Positive Predictive Value (PPV)	92.30
Negative Predictive Value (NPV)	97.22
Overall Accuracy	94

IV. Discussion

This study demonstrates that contrast-enhanced computed tomography (CT) is an effective imaging modality for evaluating adnexal masses, providing reliable differentiation between benign and malignant lesions. In our cohort, CT displayed high diagnostic performance, with a sensitivity of 92.3%, specificity of 97.22%, and an overall accuracy of 94% when compared with histopathological results. These findings align with recent research emphasizing the diagnostic value of cross-sectional imaging in assessing adnexal lesions[6]. The prevalence of cystic lesions (68%) and the high occurrence of benign pathology (72%) are consistent with the known epidemiological distribution of adnexal masses. Notably, specific CT features—such as the presence of

solid components, septal thickening, nodularity, ascites, lymphadenopathy, and peritoneal deposits—were strongly linked to malignancy, underscoring their significance as predictive markers.

When compared with existing literature, our results are consistent with recent CT- and MRI-based studies, as well as current guidelines. The diagnostic performance observed in this study aligns with previously reported sensitivity and specificity values in meta-analyses and large cohort studies[6]. Additionally, contemporary recommendations from radiological societies emphasize the role of CT in evaluating indeterminate adnexal masses and in staging suspected malignancies[1,2]. Research incorporating structured reporting systems such as O-RADS has enhanced risk stratification, although these systems are primarily based on ultrasound and MRI techniques[3,9,10]. Emerging methodologies, such as radiomics and machine learning, have shown potential for further improving diagnostic accuracy, indicating a future direction for CT-based evaluations[7].

The strengths of CT highlighted in this study include its ability to provide detailed anatomical visualization and comprehensive assessment of disease extent. CT is particularly valuable for accurately evaluating extra-ovarian disease spread, including ascites, peritoneal deposits, and lymphadenopathy, all of which are crucial for staging and prognosis [1]. This makes CT especially useful in preoperative planning and surgical decision-making. Furthermore, its wide availability, rapid acquisition time, and reproducibility enhance its utility in routine clinical practice.

However, several limitations of CT must be acknowledged. The use of ionizing radiation remains a concern, especially in younger patients or those requiring repeated imaging. Additionally, CT has relatively lower soft tissue contrast compared to MRI, which may decrease its sensitivity when characterizing indeterminate or complex lesions. Recent studies have highlighted MRI's complementary role in these situations, particularly when more detailed tissue characterization is necessary[1,9]. Despite these limitations, CT remains a practical and effective imaging modality, particularly for staging and evaluating advanced disease.

From a clinical perspective, CT serves as a critical tool for resolving uncertainties when initial imaging findings are inconclusive. It also plays a key role in preoperative staging, enabling accurate assessment of disease spread and assisting in treatment planning. Current guidelines endorse the integration of CT into diagnostic algorithms for adnexal masses, especially in cases with a high suspicion of malignancy[2]. The high diagnostic accuracy observed in this study reinforces its value in clinical decision-making[11]

V. Conclusion

In summary, contrast-enhanced computed tomography (CT) proves to be an invaluable imaging tool in the assessment of adnexal masses, providing precise characterization and effective differentiation between benign and malignant lesions. Its capacity to identify extra-ovarian spread, including peritoneal deposits and lymphadenopathy, further bolsters its role in staging and prognostic evaluation. The strong correlation observed between CT findings and histopathological diagnoses in this study supports its diagnostic reliability. With high sensitivity, specificity, and overall accuracy comparable to previously reported data CT is an essential tool in the preoperative evaluation and management of adnexal masses, making a significant contribution to informed clinical decision-making.

VI. Limitations

Despite the encouraging outcomes, there are certain limitations to this study that should be addressed. The relatively small sample size could potentially limit the statistical power and generalizability of the results. As a single-center study, there is a possibility of selection bias, which may affect the distribution of lesions observed. Furthermore, the lack of direct comparison with other advanced imaging techniques, such as magnetic resonance imaging (MRI), restricts a more comprehensive assessment of relative diagnostic performance, particularly in cases where MRI is known to provide superior soft tissue contrast and characterization. Additionally, newer diagnostic technologies such as radiomics and artificial intelligence-based models were not incorporated into this study, which could have further enhanced the diagnostic accuracy.

VII. Future Scope

Future studies should aim to include larger, multicenter cohorts to validate and generalize these findings across different populations and clinical contexts. Comparative research that integrates CT with MRI and serum tumor markers is essential to develop more robust diagnostic algorithms and enhance overall diagnostic precision^{1,2}. The integration of advanced imaging techniques, including radiomics and machine learning, shows promise in refining lesion characterization and improving risk stratification⁷. Furthermore, the establishment of standardized CT-based scoring systems, similar to existing O-RADS frameworks, could contribute to improved diagnostic consistency and better clinical decision-making in the evaluation of adnexal masses.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Ethical Clearance for the study was taken from the Institutional Ethics Committee. (MC/KOL/IEC/NON-SPON/1577/11/2022).

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