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Original Research Article

Clinic radiological and Histopathological Correlation of Adnexal Masses: Evaluating the Diagnostic Utility of Ultrasonography

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Abstract:

Background: Adnexal masses represent a wide spectrum of gynecological conditions ranging from benign cysts to malignant tumors. Accurate preoperative evaluation is essential for appropriate management, with ultrasonography (USG) being the first-line imaging modality and histopathology the gold standard.

Aim: To evaluate the clinicoradiological and histopathological correlation of adnexal masses and assess the diagnostic utility of ultrasonography.

Methodology: A prospective observational study was conducted over 6 months on 70 female patients with suspected adnexal masses. All patients underwent clinical evaluation, preoperative ultrasonography, surgical intervention, and histopathological examination. Ultrasonographic findings were correlated with histopathology to determine diagnostic performance.

Results: Most patients were of reproductive age, with abdominal pain as the commonest symptom. Ovarian origin, particularly the right ovary, predominated. Histopathology revealed 72.9% benign and 27.1% malignant lesions. Ultrasonography demonstrated a sensitivity of 89.5%, specificity of 86.3%, positive predictive value of 70.8%, negative predictive value of 95.7%, and overall diagnostic accuracy of 87.1%.

Conclusion: Ultrasonography shows good concordance with histopathology and is a reliable, noninvasive first-line tool for evaluating adnexal masses, though histopathology remains definitive.

Keywords: Adnexal masses, Ultrasonography, Histopathology, Ovarian tumors, Diagnostic accuracy.

Introduction

Adnexa is a Latin word, adnexus, which means appendage. The adnexa of the uterus known as adnexa uteri in gynecology are structures that are anatomically and functionally related to the uterus such as the ovaries, fallopian tubes and supporting ligaments [1]. Any abnormal growth or swelling in these structures is referred to as adnexal masses and is commonly found in clinical practice and may be of a wide etiology, including both benign and malignant tumors of the ovary, which are simple functional cysts, complex functional cysts, benign and malignant tumors. Out of all adnexal masses, ovarian tumours are most common and about two-thirds of the cases are of importance in clinical practice [2].

Ovarian cancer has turned out to be among the most prevalent gynecological cancers in women especially in India. Epidemiological statistics show that the disease ovarian cancer is most prevalent above age 35 years and above age 55 years to 64 years. Cancer registries in India, on a regular basis, show ovarian cancer as the third most widespread cancer amongst women with an age-adjusted incidence rate ranging between 5.4 and 8.0 per 100,000 individuals, across various regions of the country [3]. This explains why early and accurate diagnosis of adnexal masses is significant to enhance patient outcomes.

These adnexal masses are usually first examined by performing a detailed clinical examination which involves pelvic examination. Imaging is, however, critical in the characterization and management of these masses. Ultrasonography (USG) which consists of transvaginal and transabdominal imaging of the female pelvic organs has gained prominence as the procedure modality of choice in the evaluation of female pelvic organs. Ultrasonography has a number of strengths: it is non-invasive, is quite

common, is affordable and is not powered with ionizing radiation. Notably, it enables the clinician to evaluate morphological characteristics like size, composition (solid versus cystic), septations, papillary projections, and vascularity that are essential in distinguishing between benign and malignant lesions [4].

Adnexal masses definitive diagnosis is based on the histopathology which is the best diagnosis. Pathology reports are ideal confirmations of the imaging results and can be used to assess the validity of clinical and radiological diagnosis. In this regard, there is a close relationship between imaging and histopathology that is essential in determining the relevant approaches to use in management [5]. Proper preoperative characterization of adnexal masses is of great importance in terms of patient outcome as it enables conservative management of benign lesions, referral to gynecologic oncologists in time to manage suspected malignancies and over-all optimization of therapeutic decision-making.

A wide range of adnexal masses and different clinical implications will necessitate the multidisciplinary approach to management where gynecologists, radiologists, and pathologists will be beneficial to manage the issue. It has been demonstrated that ultrasonography is very sensitive towards identifying ovarian malignancies, and the specificity of the process may depend on the skills of the operator and the complexity of the mass. Therefore, it is important to note that the diagnostic value of USG in relation to histopathology is of paramount importance to achieving effective clinical decisions [6].

The current research project was aimed at determining the clinic-radiological and histopathological congruity of adnexal masses with a special focus on the diagnostic effectiveness of ultrasonography. Adnexal masses represent a very broad range of lesions, with the typical ones being functional ovarian cysts, harmless and pathological tumors, and their correct preoperative assessment is a key to the selection of proper management options. As an imaging modality, ultrasonography is non-invasive, ubiquitous, and affordable; thus, it has become the initial investigation process in the evaluation of female pelvic masses. It can distinguish cystic and solid parts, detect septations, papillary projections and vascularity, so it is an indispensable device in the clinical environment. The final diagnosis is, however, mostly based on the analysis of histopathology which is the gold standard.

Methodology

Study Design: This study was designed as a hospital-based prospective observational study aimed at evaluating the diagnostic utility of ultrasonography in adnexal masses through clinicoradiological and histopathological correlation.

Study Area: The study was conducted in the Department of Radio-Diagnosis, RDJM Medical College and Hospital, Turki, Muzaffarpur, Bihar, India.

Study Duration: The duration of the study was 6 months from March 2025 to August 2025.

Sample Size: A total of 70 patients with clinically suspected adnexal masses were included in the study.

Study Population: The study population consisted of female patients presenting with adnexal masses who underwent pre-operative ultrasonographic evaluation followed by surgical intervention and histopathological examination of the excised specimen.

Data Collection: After obtaining informed written consent, data were collected prospectively using a predesigned and structured proforma. Detailed clinical information including age, parity, menstrual status, presenting symptoms, and relevant laboratory parameters such as serum CA-125 levels (where available) was recorded. All patients underwent pre-operative ultrasonographic evaluation of the adnexal masses using transabdominal and/or transvaginal approaches in the Department of Radio-Diagnosis. Ultrasonographic parameters such as size, laterality, internal echotexture, presence of septations, solid components, papillary projections, and associated findings were documented. Following ultrasonographic assessment, patients underwent surgical intervention as per clinical indication. The excised specimens, which included ovarian, para-ovarian, fallopian tube, and other adnexal lesions, were sent for histopathological examination. Specimens were fixed in 10% buffered formalin, processed routinely, and stained with Haematoxylin and Eosin stain. Histopathological findings were recorded and considered as the definitive diagnosis for correlation with ultrasonographic impressions.

Histopathological Examination: All specimens were fixed in 10% buffered formalin, processed routinely, and stained with Haematoxylin and Eosin (H&E). Microscopic examination was carried out by experienced pathologists.

Inclusion Criteria

- Female patients of any age with clinically or radiologically suspected adnexal masses
- Patients who underwent pre-operative ultrasonography
- Patients who subsequently underwent surgical resection of the adnexal mass
- Availability of histopathological reports
- Patients who provided informed written consent

Exclusion Criteria

- Patients with only radiological diagnosis without histopathological confirmation
- Patients with histopathological reports but no pre-operative ultrasonography
- Patients managed conservatively without surgery
- Patients who did not provide informed consent

Procedure: Patients presenting with adnexal masses underwent clinical evaluation followed by ultrasonographic assessment in the Department of Radio-Diagnosis. Based on clinical and radiological findings, surgical management was planned. The excised specimens were sent for histopathological examination. Ultrasonographic diagnoses were then correlated with histopathological findings to assess diagnostic accuracy.

Statistical Analysis: The collected data were compiled and entered into Microsoft Excel and subsequently analyzed using Statistical Package for the Social Sciences (SPSS) software version 20. Descriptive statistics such as mean, standard deviation, frequencies, and percentages were used to summarize demographic, clinical, ultrasonographic, and histopathological variables. Ultrasonographic diagnoses were compared with histopathological findings, which served as the gold standard. Diagnostic performance of ultrasonography was assessed by calculating sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy. Appropriate univariate and bivariate analyses were performed to evaluate associations between radiological and histopathological findings. Results were presented in the form of tables and graphs, and a p-value of less than 0.05 was considered statistically significant."

Result

Table 1 depicts the age-wise distribution of 70 cases with adnexal masses. The highest number of cases was observed in the 31–40 years age group, comprising 22 patients (31.4%), followed by the 21–30 years group with 18 cases (25.7%). Patients aged 41–50 years accounted for 14 cases (20%), while those above 50 years constituted 10 cases (14.3%). The youngest age group (≤20 years) had the lowest representation, with 6 cases (8.6%). Overall, the findings indicate that adnexal masses were most commonly encountered in women of reproductive age.

Table 1: Age Wise Distribution of Cases (N = 70)

Age Group (Years)	Number of Cases	Percentage (%)
≤20	6	8.6
21–30	18	25.7
31–40	22	31.4
41–50	14	20
>50	10	14.3
Total	**70**	**100**

Table 2 outlines the presenting complaints of 70 patients with adnexal masses. The most common symptom was abdominal pain with or without distension, reported by 56 patients (80%), indicating it as the predominant clinical presentation. Menstrual irregularities were observed in 9 cases (12.9%), while urinary complaints were the least frequent, reported by 5 patients (7.1%). Overall, the table highlights abdominal pain as the primary presenting symptom among patients in this study.

Table 2: Presenting Complaints of Patients (N = 70)

Symptoms	Number of Cases	Percentage (%)
Abdominal pain with or without distension	56	80
Menstrual irregularities	9	12.9
Urinary complaints	5	7.1
Total	**70**	**100**

Table 3 shows the radiologically confirmed site of adnexal lesions in 70 cases. The right ovary was the most commonly involved site, with 38 cases (54.3%), followed by the left ovary in 16 cases (22.9%). Bilateral ovarian involvement and uterine subserosal lesions were observed in 5 cases each (7.1%), while fallopian tube lesions accounted for 4 cases (5.7%). Broad ligament involvement was least common, seen in 2 cases (2.9%). Overall, the findings indicate a clear predominance of ovarian origin for adnexal lesions, particularly involving the right ovary.

Table 3: Radiologically Confirmed Site of Adnexal Lesion (N = 70)		
Site of Lesion	**Number of Cases**	**Percentage (%)**
Right ovary	38	54.3
Left ovary	16	22.9
Bilateral ovaries	5	7.1
Fallopian tube	4	5.7
Uterine subserosal	5	7.1
Broad ligament	2	2.9
Total	**70**	**100**

Table 4 describes the ultrasonographic nature of adnexal masses in 70 cases. The majority of adnexal masses were solid-cystic in appearance, accounting for 36 cases (51.4%), followed by cystic masses in 28 cases (40%). Purely solid masses were least common, observed in 6 cases (8.6%). This distribution suggests that mixed solid-cystic morphology is the predominant ultrasonographic pattern among adnexal masses in the study population, which may have important implications for differential diagnosis and malignancy risk assessment.

Table 4: Ultrasonographic Nature of Adnexal Masses (N = 70)		
Nature of Mass	**Number of Cases**	**Percentage (%)**
Cystic	28	40
Solid	6	8.6
Solid-cystic	36	51.4
Total	**70**	**100**

Table 5 presents the histopathological classification of adnexal masses in 70 cases. Benign lesions constituted the majority, with 51 cases accounting for 72.9% of the total, while malignant lesions were identified in 19 cases, representing 27.1%. This distribution indicates that most adnexal masses in the study population were benign, though a substantial proportion were malignant, underscoring the importance of accurate diagnostic evaluation.

Table 5: Histopathological Classification of Adnexal Masses (N = 70)		
Histopathological Diagnosis	**Number of Cases**	**Percentage (%)**
Benign lesions	51	72.9
Malignant lesions	19	27.1
Total	**70**	**100**

Table 6 shows the distribution of benign adnexal lesions among 51 cases. Serous cystadenoma was the most common benign lesion, comprising 15 cases (21.4%), followed by mucinous cystadenoma with 11 cases (15.7%) and leiomyoma involving the broad ligament or subserosal region with 9 cases (12.9%). Mature cystic teratoma accounted for 8 cases (11.4%), while endometriotic cysts and ectopic pregnancy were less frequent, each contributing 4 cases (5.7%). Overall, benign adnexal lesions constituted 72.9% of the total study population, indicating a predominance of non-malignant adnexal pathology in this cohort.

Table 6: Distribution of Benign Adnexal Lesions (N = 51)		
Benign Lesion Type	**Number of Cases**	**Percentage (%)**
Serous cystadenoma	15	21.4
Mucinous cystadenoma	11	15.7
Mature cystic teratoma	8	11.4
Endometriotic cyst	4	5.7
Leiomyoma (broad ligament/subserosal)	9	12.9
Ectopic pregnancy	4	5.7
Total	**51**	**72.9**

Table 7 depicts the distribution of malignant adnexal lesions among 19 cases. Serous cystadenocarcinoma was the most common malignancy, accounting for 6 cases (8.6%), followed by mucinous carcinoma with 4 cases (5.7%) and granulosa cell tumor with 3 cases (4.3%). Less frequent malignancies included endometrioid carcinoma and dysgerminoma with 2 cases each (2.9%), while yolk sac tumor and Krukenberg tumor were the least common, each contributing 1 case (1.4%). Overall, malignant

adnexal lesions constituted 27.1% of the study population, highlighting the predominance of epithelial ovarian malignancies in this cohort.

Table 7: Distribution of Malignant Adnexal Lesions (N = 19)		
Malignant Lesion Type	**Number of Cases**	**Percentage (%)**
Serous cystadenocarcinoma	6	8.6
Mucinous carcinoma	4	5.7
Endometrioid carcinoma	2	2.9
Granulosa cell tumor	3	4.3
Dysgerminoma	2	2.9
Yolk sac tumor	1	1.4
Krukenberg tumor	1	1.4
Total	**19**	**27.1**

Table 8 illustrates the correlation between ultrasonography and histopathological findings in 70 cases. Ultrasonography correctly identified malignancy in 17 cases that were histopathologically malignant, while 7 cases diagnosed as malignant on ultrasonography were found to be benign on histopathology. Among cases labeled benign on ultrasonography, 44 were confirmed as benign on histopathology, whereas 2 cases were histopathologically malignant, indicating false-negative results. Overall, ultrasonography showed good concordance with histopathology, with correct classification in 61 out of 70 cases, supporting its usefulness as a reliable, though not definitive, diagnostic tool.

Table 8: Correlation Between Ultrasonography and Histopathology (N = 70)			
Ultrasonography Diagnosis	**Histopathology Malignant**	**Histopathology Benign**	**Total**
Malignant	17	7	24
Benign	2	44	46
Total	**19**	**51**	**70**

Table 9 summarizes the diagnostic performance of ultrasonography, demonstrating high overall reliability. Ultrasonography showed a sensitivity of 89.5% and specificity of 86.3%, indicating a strong ability to correctly identify both diseased and non-diseased cases. The positive predictive value was 70.8%, while a high negative predictive value of 95.7% reflects excellent confidence in ruling out disease when ultrasonography findings were negative. The overall diagnostic accuracy of 87.1% further confirms ultrasonography as an effective diagnostic modality in the evaluation of early pregnancy conditions.

Table 9: Diagnostic Performance of Ultrasonography	
Diagnostic Parameter	**Value (%)**
Sensitivity	89.5
Specificity	86.3
Positive Predictive Value	70.8
Negative Predictive Value	95.7
Overall Diagnostic Accuracy	87.1

Discussion

The current paper identifies the clinicoradiological and histopathological continuum of adnexal masses and supports the key role of ultrasonography as a diagnostic modality. The fact that in our sample of 70 patients, the adnexal masses are the most common in the reproductive age group, especially 3140 years (31.4%), is also in line with other previous studies that have also observed a higher rate of such masses in women of reproductive age due to the presence of functional ovarian activity and the probability of benign neoplasms being reported (Anant et al., 2020; Priya et al., 2017) [7,8]. Puttaveerachary et al. and Radhamani and Akhila have reported similar age distributions, with most of the cases being found in the third and fourth decades of life (Puttaveerachary et al., 2017; Radhamani and Akhila, 2017) [9,10]. The relatively small number of cases above 50 years in our research is in line with the fact that even though adnexal masses are less common in post menopause women, the probability of these masses being malign is higher in this group of women, which is why caution should be taken."

Abdominal pain, with or without distension, was the top complaint of clinical presentations in our patients (80%), and menstrual irregularities were also relatively uncommon (12.9%). These results are highly similar to those, which were found by Biggs and Marks, who identified abdominal pain as the most frequent symptom, in women with abdominal masses, and menstrual disturbances as less frequent (Biggs and Marks, 2016) [11]. Similar percentage of pain as a chief complaint has been reported by Al-Shukri et al., with nonspecific abdominal symptoms prevailing as the clinical manifestation (Al-Shukri et al., 2014) [12]. This resemblance highlights how clinical features per se are typically nonspecific and inadequate to distinguish benign and malignant lesions to a high degree of reliability, and thus correlation with imaging and histopathology is needed.

In our study, radiologically, most of the adnexal masses were of ovarian origin, and the right ovary was more involved than the left one. This is in line with several studies that suggest the ovary to be the most frequent cause of adnexal pathology (Anitha & Ali, 2021; Mankar and Jain, 2015) [13,14]. The relative low incidence of the uterine, tubal and broad ligament lesions in our series is also reminiscent of previous studies and argues that the non-ovarian adnexal masses always represent a minority but still diagnostically significant as they share imaging characteristics.

Mixed solid-cystic masses were the most prevalent (51.4) with purely cystic lesions (40). Aruna Kumari and Suman Chandra reported similar distributions and discovered that malignant lesions were more frequently mixed echogenic and benign lesions were more likely to be cystic (Aruna Kumari & Chandra, 2016) [15]. Priya et al. also established that cystic morphology was more indicative of benign disease, and solid or mixed lesions were susceptive of malignancy (Priya et al., 2017) [8]. We thus confirm the existing sonographic standards applied in risk stratification although some overlap exists between benign and malignant patterns.

Histopathologically, benign lesions comprised 72.9 per cent of the cases in our study, serous cystadenoma was most common benign tumor (21.4%), then there was mucinous cystadenoma (15.7%). Such trend is strongly associated with works by Patel et al. and Jha and Karki, who also discovered serous cystadenoma as the most common benign neoplasm in the ovaries (Patel et al., 2018; Jha and Karki, 2008) [16,17]. Serous cystadenocarcinoma was the most prevalent malignant lesions (8.6%), which is in line with the prevalence of epithelial cancers of the ovary reported in the literature (Anitha and Ali, 2021) [13]. The fact that the incidence of germ cell and sex-cord stromal tumors in our series is relatively low is similar in other studies based on tertiary care and demonstrates their overall uncommonness.

In our experiment, the diagnostic accuracy of ultrasonography was high, with sensitivity (89.5) and specificity (86.3) being high, and the overall accuracy (87.1) being high. These values can be compared to the large meta-analysis, in which sensitivity was 86-91 and specificity was 68-83 to detect ovarian malignancy by use of ultrasound (Myers et al., 2006) [18]. Similar values of sensitivity and specificity were also reported by Radhamani and Akhila, which confirms the usefulness of ultrasonography as a diagnostic and screening method (Radhamani and Akhila, 2017) [10]. Nevertheless, false-positive and the false-negative cases were observed in our research indicating the inherent limitations of ultrasound, especially in lesions of indeterminate morphology, and the necessity of the confirmatory use of histopathology.

In general, clinicoradiological and histopathological correlations that were reported in this study are mostly consistent with the existing literature. The results support the claim that ultrasonography is a good modality, noninvasive, and easily available, thus effective in the initial examination of adnexal masses, and has a high diagnostic accuracy. However, cases of adnexal masses still depend on histopathological examination and definitive diagnosis and prognostication, with imaging and pathology being complementary to each other in the management of adnexal masses.

Conclusion

This paper shows that the adnexal masses are most frequently encountered in women of reproductive age, and the most common presenting symptom is abdominal pain, and most often the ovary is the most common site of involvement. The ultrasonography was able to describe most of the lesions and solid and cystic patterns were more frequently seen and demonstrated good agreement with the histopathology findings in the differentiation of benign and malignant masses. The majority of lesions in the adnesal region were benign with epithelial tumours constituting the biggest category with malignant lesions though less in number cutting across the spectrum of ovarian neoplasms. The high clinicoradiological-histopathological correlation between ultrasonography and the assessment of adnexal masses indicates that the former is a good first-line diagnostic modality due to its high quality and reliability, as well as its capacity to help in diagnosing the patient early, making the right clinical decision-making, and managing a patient appropriately, and histopathology is the critical component of the definitive diagnostic tool.

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