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Evaluation of Adnexal Masses: Diagnosis of Adnexal Masses by Histopathology Versus Diagnosis by Other Imaging Tools

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Abstract

Background: Adnexal masses are frequently encountered in gynecological practice, presenting with diverse clinical features ranging from benign cysts to malignant tumors. An accurate preoperative diagnosis is essential for differentiating benign and malignant lesions facilitating an effective treatment strategy. The definitive diagnosis could only be achieved through post-operative histopathology. Ultrasonography (USG), especially transvaginal ultrasound (TVUS), has emerged as a preferred imaging technique due to its easy availability, non-invasive nature, and real-time imaging. The objective of this study was to assess the diagnostic precision of USG in identifying adnexal masses, utilizing histopathology as the definitive standard.

Methodology: An observational study was conducted at the Department of Obstetrics and Gynecology, Rawal General and Dental Hospital, Islamabad, Pakistan from [start date] to [end date]. A total of 132 female patients with USG-confirmed adnexal masses were recruited using consecutive non-probability sampling techniques. The study excluded pregnant women, patients with metastatic malignancies, and those with non-operable adnexal masses. Detailed demographic data, clinical presentations, and ultrasound findings were collected. Each patient underwent surgical resection of the adnexal mass, and the specimens obtained were sent for histopathological examination. Data analysis was performed using SPSS version 26, with results expressed as frequencies, percentages, means, and standard deviations. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of USG were calculated for different types of adnexal masses.

Results: The mean age of the participants was 39.5 ± 10.4 years, with 61.3% being married. The predominant clinical symptom reported was abdominal or pelvic pain, observed in 76.5% of the cases, followed by post-menopausal bleeding at 33.3% and the sensation of a lump at 42.4%. Ultrasound findings indicated that a significant majority of adnexal masses exhibited a cystic morphology (68.1%), were found to be unilateral (92.4%), and were primarily derived from the ovary (87.1%). Histopathological analysis identified endometrioma as the predominant diagnosis, accounting for 21.2% of cases, with dermoid cysts following at 18.9%. Ultrasound imaging exhibited the highest sensitivity for follicular cysts at 90% and dermoid cysts at 88%. Regarding specificity, hydrosalpinx and tubo-ovarian abscesses demonstrated the highest rates, at 97% and 95%, respectively. Overall, ultrasound imaging proved to be a reliable diagnostic tool, achieving a sensitivity of 81.4% and a specificity of 89% for malignancy.

Conclusion: The findings of this study emphasize the role of USG as a reliable diagnostic tool for evaluating adnexal masses, demonstrating significant sensitivity and specificity for both benign

and malignant conditions. Despite its operator-dependent nature, USG remains a crucial and cost-effective tool for preoperative assessment, particularly in resource-limited healthcare settings.

Keywords: Adnexal Mass, Ultrasound, Histopathology, Specificity, Sensitivity, Diagnosis

Introduction

An adnexal mass is defined as a growth in the pelvic region of a female, known as the adnexa, including the ovaries, fallopian tubes, and nearby connective tissues. These masses may arise from the reproductive system or neighboring pelvic organs, such as the intestines or bladder.(1) While most adnexal masses are benign, malignancy is also the potential cause of an adnexal mass. The symptoms related to adnexal masses can differ significantly depending on the root cause and the size of the mass. The most common symptom is pelvic pain, which may point to several other potential causes, such as ectopic pregnancy, or ovarian torsion. Abdominal bloating, increased urinary retention, or frequency could also occur attributing to the pressure of solid masses on nearby organs.(2)

The diagnosis and management of adnexal masses have significance in gynecology, indicating the need for reliable diagnostic methods to effectively differentiate benign and malignant lesions.(3) Determining the characteristics of an adnexal mass is essential for the treatment, which involves evaluating the need for surgery or oncological management. Histopathological examination is considered the definitive standard for diagnosis. However, it is typically performed after surgical intervention, indicating the requirement of reliable imaging techniques before surgery.(4, 5)

Among the numerous diagnostic imaging techniques available, ultrasound (USG) has become commonly used owing to its accessibility, non-invasive nature, and cost-effectiveness.(6) Transvaginal USG (TVUS) is often regarded as the imaging modality of choice for the evaluation of adnexal masses. Its ability to provide real-time imaging facilitates the comprehensive evaluation of the dimensions, morphology, echogenic properties, and vascularity of the adnexal mass. Doppler USG further elaborates on vascular flow patterns, differentiating the benign and malignant lesions. However, the diagnostic accuracy of USG is highly operator-dependent with significant variance among different observers.(7, 8) The difference between benign and malignant masses could overlap on USG, especially in borderline tumors or endometriomas. Computed tomography (CT) or magnetic resonance imaging (MRI) could provide an evaluation of perplexing adnexal masses, however, these imaging modalities are less cost-effective and low availability, especially in resource-limited healthcare settings signifying the improvement in the diagnostic potential of USG.(9, 10)

The critical role of USG in the diagnosis of adnexal mass required the comparison with histopathology for imperative evaluation of diagnostic imaging modality. This study aims to evaluate the sensitivity and specificity of ultrasonography for the diagnosis of adnexal mass by considering histopathology as a gold standard investigation for the diagnosis.

Methodology

Study Design and Setting

A prospective observational study was conducted at the Department of Obstetrics and Gynecology, Rawal General and Dental Hospital, Islamabad, Pakistan from January 2024 to December 2024. The female patients belonging to the reproductive and post-menopausal age group with the confirmed diagnosis of adnexal mass on ultrasonography were included. Pregnant females, malignant disease with metastasis, and non-operatable adnexal mass were excluded.

Sample Size

The 132-sample size was calculated using the WHO sample size calculator. The confidence interval was 90%, the margin of error was 5%, the response rate was 85%, and the estimated population was 20000.(11)

Ethical Considerations

Informed consent was obtained from all participants before their inclusion in the study. To keep participation anonymous, the personal information of participants was not recorded. Ethical approval was acquired from the institutional review board of the Rawal Institute of Health Sciences with reference number RIHS-REC/093/22 and the study was conducted in accordance with the Declaration of Helinski.

Data Collection

A consecutive non-probability sampling technique was used to include the participants presenting at the Department of Obstetrics and Gynecology, Rawal General and Dental Hospital, Islamabad, Pakistan. The information of the participants such as age, marital status, clinical presentation, and the findings on the transvaginal ultrasound along with the diagnosis were recorded. All the patients had undergone the surgical intervention for the resection of adnexal mass and the type of surgery performed varied depending upon the diagnosis, patient's demand, and physiological status. Post-operatively, the resected specimen was sent for histopathological analysis at the Department of Pathology, Rawal General and Dental Hospital to confirm the diagnosis.

Data Analysis

All the data was recorded on a pre-designed proforma and was entered into Microsoft Excel. Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 26. Qualitative variables such as marital status, clinical presentation, findings on transvaginal ultrasound, and histopathological diagnosis were presented as frequency and percentage. Quantitative variables such as age were presented as mean and standard deviation. Sensitivity and specificity of USG was calculated against the histopathological diagnosis of adnexal mass.

Results

A total of 132 patients were included in the study with a mean age of 34.5 ± 10.4 years. 81 (61.3%) participants were married. The mean duration of the symptoms was 69 ± 20.4 days. The most common symptoms were abdominal or pelvic pain 101 (76.5%), feeling of a lump 56 (42.4%), and abdominal fullness 42 (31.8%). The most common bleeding abnormalities were post-menopausal bleeding 44 (33.3%), and polymenorrhagia 35 (26.5%). (Table 1)

Table 1: Demographic characteristics of the participants

Variables	**Mean ± Standard Deviation**
Age (In years)	39.5 ± 10.4
Duration of Symptoms (In days)	69 ± 20.4
Marital Status	**Frequency (Percentage)**
Married	81 (61.3%)
Unmarried	51 (38.7%)
Symptoms	
Abdominal or pelvic pain	101 (76.5%)
Feeling of lump	56 (42.4%)
Polymenorrhagia	35 (26.5%)
Oligomenorrhea	17 (12.8%)
Amenorrhea	15 (11.3%)
Post-menopausal bleeding	44 (33.3%)
Infertility	9 (6.8%)
Abdominal fullness	42 (31.8%)

Constipation	39 (29.5%)
Urinary retention	25 (18.9%)
Incidental finding	6 (4.5%)

The mean size of mass on ultrasonography was 6.27 ± 3.84 cm. The majority, 90 (68.1%) findings on USG had cystic appearance, 122 (92.4%) were unilateral and 115 (87.1%) had origin from the ovary. (Table 2)

Table 2: Findings on USG

Variables	**Frequency (Percentage)**
Mean size of mass (cm)	6.27 ± 3.84
Appearance	
Solid	16 (12.1%)
Cystic	90 (68.1%)
Solid cystic	26 (19.6%)
Position	
Unilateral	122 (92.4%)
Bilateral	10 (7.6%)
Origin of Lesion	
6Ovarian	115 (87.1%)
Paraovarian	12 (9.0%)
Tubal	5 (3.7%)

The histopathological analysis of the resected adnexal mass indicated the endometrioma as the most common finding 28 (21.2%) followed by dermoid cyst 25 (18.9%). The malignant cases diagnosed included borderline tumors 9 (6.8%), germ cell tumor 5 (3.7%) and metastatic disease 3 (2.2%). (Table 3)

Table 3: Diagnosis on Histopathology

Variables	**Frequency (Percentage)**
Dermoid cyst	25 (18.9%)
Follicular cyst	11 (8.3%)
Endometrioma	28 (21.2%)
Hemorrhagic cyst	5 (3.7%)
Serous Cystadenoma	8 (6.0%)
Mucinous Cystadenoma	7 (5.3%)
Para-ovarian cyst	10 (7.5%)
Tubo-ovarian abscess	7 (5.3%)
Hydrosalpinx	4 (3.0%)
Chronic ectopic	1 (0.7%)
Ovarian fibroma	4 (3.0%)
Borderline tumors	9 (6.8%)
Germ cell tumor	5 (3.7%)
Fibroma	5 (3.7%)
Metastatic disease	3 (2.2%)

USG had the highest sensitivity for follicular cysts at 90.9%, dermoid cysts at 88%, and endometrioma at 82.1%. USG had the highest specificity for dermoid cyst at 93%, hydrosalpinx at 97%, tubo-ovarian abscess at 95% and para-ovarian cyst at 93%. (Table 4)

Table 4: Sensitivity and Specificity of USG for adnexal mass

Diagnosis (N=132)	Ultrasound	Total cases	Sensitivity	Specificity
Dermoid Cyst	22	25	88%	98%
Follicular Cyst	10	11	90.9%	91%
Para-ovarian Cyst	8	10	80%	93%
Endometrioma	23	28	82.1%	78%
Cystadenoma	10	15	66.6%	84%
Hemorrhagic Cyst	3	5	60%	91%
Tubo-ovarian abscess	5	7	71.4%	95%
Hydrosalpinx	3	4	75%	97%
Malignancy	22	27	81.4%	89%

Discussion

Adnexal mass is a common gynecological disease with varied presentations, ranging from benign cysts to metastatic diseases. USG can differentiate between benign and malignant adnexal masses and diagnose the adnexal mass according to the exact histological diagnosis.(12) In this study, the diagnostic accuracy of USG for adnexal mass is evaluated by comparing it to histopathology as a gold standard.

Abdominal or pelvic pain was the most common symptom of the adnexal mass in 76.5%. Anant et. al reported that pain was the chief complaint of adnexal mass patients (73.2%) followed by the feeling of a lump (26.87%) and dysmenorrhea (19.37%).(13) Bhatty et.al also reported similar findings that 45% of the patients with the adnexal mass presented with abdominal pain.(14) Adnexal masses are usually asymptomatic and could be diagnosed incidentally. The symptoms depend on the size and location of the mass or the compression effects of the mass on the surrounding structures. The most common presentation of the adnexal mass is usually abdominal pain.(15) The patients presenting with symptomatic adnexal masses had an elevated risk of malignancy. Ovarian cancer typically presents with nonspecific symptoms resembling irritable bowel syndrome, vague gastric complaints, fatigue, and unexplained weight loss. The signs of infiltration or compression may arise as an increase in the size of the abdomen, resulting in abdominal or pelvic pain, alterations in bowel habits, abnormal uterine bleeding, and a sensation of bladder fullness.(16, 17)

USG had the highest sensitivity for the follicular cyst (90.9%) and dermoid cyst (88%). Bhatty et.al reported the role of USG in the diagnosis of adnexal mass with the highest sensitivity for functional cysts (92.9%) and para-ovarian cysts (91.7%). The sensitivity and specificity for the dermoid cyst were 80% and 94.4%, respectively.(14) Theodoros et.al demonstrated that TVUS had a sensitivity of 94% for simple ovarian cysts and 80% for dermoid cysts.(18) USG had a significant role in detecting the adnexal masses with cystic or well-defined morphological features. Anant et.al also reported similar findings that USG has 95% sensitivity for dermoid and 90% sensitivity for follicular cysts.(13) USG had a significant role in detecting the adnexal masses with cystic or well-defined morphological features. USG had the lowest sensitivity for hemorrhagic cysts (60%) and cystadenoma (66%). Alcazar et.al reported that the ultrasound characteristics of hemorrhagic cysts and borderline tumors frequently overlap, resulting in diagnostic challenges. Moreover, although Doppler ultrasound assists in recognizing vascular flow patterns that may be indicative of malignancy, its diagnostic reliability for borderline and complex cystic lesions remains insufficient.(19)

TVUS had 81.4% sensitivity and 89% specificity for the diagnosis of malignancies. Anant et.al reported 84.9% sensitivity and 90.9 specificity of TVUS for the diagnosis of adnexal malignancy.(13) The sensitivity of TVUS for identifying malignancies is usually 90%, with

specificity between 51% and 97%. Malignancies can be identified on the USG based on specific identifiable features such as bilaterality, presence of thick septa, vascular projections, solid components in the mass, and pelvic ascites. The assessment of suspicion is largely influenced by the imaging characteristics observed. TVUS is regarded as the primary imaging approach for evaluating ovarian diseases, as it is cost-effective, noninvasive, well-accepted by patients, and readily accessible. TVUS is generally preferred over abdominal ultrasound, however, the restricted field of examination can impede the thorough examination of the uterus, ovaries, or masses located in the upper pelvic region.(10) The reliability of USG as a screening tool for malignancies is acknowledged; however, its diagnostic accuracy for specific malignant lesions, including germ cell tumors and metastatic masses, can vary depending upon the expertise of the operator and the complexity of the lesions.(20)

Limitations

The diagnostic accuracy of USG is subjected to the operator-dependent nature of the procedure and is influenced by the varying skills and experiences of practitioners. This can lead to differences in sensitivity and specificity, particularly in complex cases. This study is conducted at a single center, and the findings may not extend to other healthcare contexts. Furthermore, the exclusion of particular patient groups, such as pregnant individuals, those with metastatic diseases, and patients with non-operable masses, diminishes the applicability of the results to a larger population. Furthermore, the lack of comparative analysis with other imaging methods like computed tomography (CT) or magnetic resonance imaging (MRI) limits the ability to conduct a comprehensive evaluation and the potential for misclassification in histopathological diagnoses.

Conclusion

USG is a significant and readily available diagnostic tool for the preliminary assessment of adnexal masses, demonstrating high sensitivity and specificity for various benign and malignant conditions when evaluated against histopathology. It signifies the efficacy of USG in distinguishing between different types of adnexal masses, supporting its role in clinical decision-making and preoperative planning. Although there are limitations, including operator dependency, the exclusion of specific patient populations, and the lack of comparative analysis with other imaging techniques, ultrasound continues to be an essential instrument in gynecological practice, particularly in settings with limited resources. Future research involving larger, multi-center populations, standardized training for operators, and sophisticated scoring systems has the potential to significantly improve diagnostic accuracy, leading to improved patient outcomes and more effective management of adnexal masses.

Conflict of Interest

None

Funding

None

Author Contribution

SA and RM conceived the idea. SA, NHQ, and NH collected data. SA, NHQ, NH, and MJ did the literature review and manuscript writing. SA, SK, and RM review and edit the manuscript.

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