Original Article

Evaluating the Diagnostic Accuracy of Ultrasound in Differentiating Ovarian Neoplasms: A Gold Standard Comparative Exam

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ABSTRACT

Objective: To determine the diagnostic accuracy of ultrasonography following ovarian neoplasms referred for laparotomy.

Study Design: It was a single-center study

Place and Duration of Study: This study was conducted at the Department of Radiology, HMC Peshawar, Pakistan from January 2023 to July 2023.

Methods: Women aged between 25-65 presented with an ovarian lesion of more than 9 cm size on ultrasonography. Laparotomies were performed subsequently, and the histological findings were considered the gold standard. Proceeded to laboratory correlation using 02 x 02 tables inclusive of sensitivity, specificity, positive predictive value , and negative predictive value , and overall diagnostic accuracy with histology as the gold standard.

Results: Out of the 100 subjects, an average of 33.02 ± 04.37 years was the mean age, and the average duration of symptoms was 26.66 ± 12.01 months. 87 subjects (87.8%) presented with more than two parities, while thirteen of them (12.8%) had only one. The sensitivity of ultrasonography was 80.62%, specificity was 75.70%, PPV was 95.88%, NPV was 51.62%, and the overall diagnostic accuracy was 71.21% for differential diagnosis of malignancy following ovarian neoplasms with histology as the gold standard. Conclusion: Compared to histology, ultrasonography shows a high level of sensitivity and diagnostic accuracy while demonstrating moderate specificity in detecting malignant ovarian neoplasms.

Conclusion: The study proved the efficacy of ultrasonography in the examination of ovarian neoplasms, showing high sensitivity and PPV. Although specificity and NPV were fair, ultrasonography proved to be the noninvasive imaging technique. Future research should focus on challenges related to the identification of sophisticated lesions to enhance diagnostic test accuracy and patient outcomes.

Key Words: ovarian masses, ultrasound, ovarian cancer, specificity, sensitivity.

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INTRODUCTION

Ultrasound Primary imaging maladies include Ovarian Vietnam, is low-cost, easy readily available than noninvasively getting better repercussions because ultrasound uses real-time pictures. This approach makes sense for physicians[1].

On a screen they can see images of ovary masses and their characteristics such as size, shape or internal structure in terms of high resolution sonography Del Río Ultra-sonography can thus be helpful for light dusting, and it is very helpful in helping with diagnosis. Ovarian Ultrasound This is a contentious area[2]. Normal studies claim to have detected more than 92% of all ovarian malignant tumors within eight weeks using ultrasound[3]. On the other hand other researchers emphasize that its sensitivity drops with increasing malignancy: central necrosis and solid mass (complex lesions) are harder to identify accurately on sonography because they have undefined boundaries or structure (these may be explained in this context as "operator-dependence")[4].As a further example, the invasive nature of histological examination on ovarian tissue breathtakingly abrades its available efficacy for primary diagnosis which therefore falls back upon imaging modalities such as ultrasound.[5] The impact of whole body imaging techniques on diagnostic procedures in gynecological malignancy generally speaking, Ultrasound has emerged as a new tool that enables our approach to human health/domestic medicine, not only now for diagnosis[6].Due to the significance of making

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an accurate diagnosis prior to operation, which in turn can determine both patient management strategies and results, there is a need to thoroughly investigate how effective ultrasounds are in distinguishing different types of ovarian neoplasms[7]. It is only by examining ultrasound's data against the histological gold standard that these questions can be answered. This study aims to evaluate the diagnostic performance of ultrasound in differentiating between ovarian neoplasms using tumor histology as a reference standard[8]. We will examine sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) to learn more about the characteristics and limitations of ultrasound for distinguishing benign from malignant ovarian masses[9].In addition, we hope to point out possible influencing factors such as patient and lesion characteristics, clinical presentation and so on, in order to find out what changes might be made to make Ultrasound more useful for diagnosis of ovarian neoplasms[10].finding of our study present an original contribution to the field of ovarian imaging and fill an important gap in related literature by offering an assessment of ultrasound diagnostic accuracy for ovarian neoplasms. For it is only by evaluating the strengths and limitations in this way that we should be able to influence clinical practice in future.

METHODS

This single-center study was conducted at the Department of Radiology, HMC Peshawar, Pakistan, from January 2023 to July 2023. The study included women aged 25 to 65 with ovarian lesions measuring more than 9 cm on ultrasonography. Patients underwent laparotomies following ultrasonography procedures, and excised ovarian tissue was subjected to histopathological examination. Diagnostic accuracy was assessed using 2x2 contingency tables, with sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) calculated relative to histological results. The study aimed to determine the performance characteristics of ultrasonography in discriminating between benign and malignant ovarian neoplasms, utilizing histology as the gold standard. Ethical approval was obtained from the institutional review board, and informed consent was obtained from all participants prior to inclusion.

Sample Size Estimation: The sample size for this study was estimated using a diagnostic accuracy sample size calculator. With a sensitivity of 70%, specificity of 89%, and a prevalence of 51%, along with a margin of error of 10% for sensitivity and 6.2% for specificity, the estimated sample size was determined to be 100.

Sampling Technique: A non-probability consecutive sampling technique was employed for participant selection. This method involved recruiting participants consecutively as they presented at the Department of Radiology, HMC Peshawar, Pakistan, meeting the inclusion criteria of age, ovarian lesion size, and willingness to undergo laparotomy following ultrasonography. This approach aimed to include a representative sample of patients undergoing evaluation for ovarian neoplasms during the study period, ensuring the generalizability of the findings to the target population.

Inclusion criteria Women who have ovarian masses will have laparotomies; they must be between the ages of 25 and 75; and they must have ovarian lesions larger than 9 cm.

Exclusion criteria The following patients are excluded Those who have previously been diagnosed with an ovarian tumour Women who are pregnant and have ovarian lesions on regular ultrasounds and Patients who have a history of bleeding issues patients are unwilling to take part in the research

Data Collection Procedure: Following informed permission, patients who have presented to the radiology and gynaecology departments and who meet the inclusion criteria as per the ethical committee letter of approval will be recruited in this research. A thorough medical history and clinical assessment will be performed. Following a laparotomy, all of the chosen patients will have a new ultrasound to check for ovarian neoplasms and will have a biopsy for histology. A senior sonologist with more than three years of experience will take the ultrasound. A specimen will be obtained during the laparotomy, preserved in 8% formalin, and submitted right away to the diagnostic lab for histology. The performa included notes on all the research factors, including age, place of residence, parity, and the presence of an ovarian tumour on ultrasound and histology.

Data analysis: The statistical software SPSS version 28.0 will be used to input and analyse the data. Quantitative factors such as age, parity, and length of illness were calculated using the mean, standard deviation, or median. For the location of residency, the results of the ultrasound, and the results of the biopsy, simple frequency and percentage were determined. Using histology as the gold standard, the 02 x 02 table was used to determine the sensitivity (SE), specificity (SP), positive predictive value (PPV), negative predictive value (NPV), and accuracy of "ultrasound findings." The effect modifiers of age, residency, length of disease, and parity will be taken into account in the post-stratification 02 x 02 table, which was calculated to determine the ultrasound's sensitivity, specificity, ppv, npv, and diagnostic accuracy.

RESULTS

Diagnostic precision of ultrasonography identifying the nature of ovarian tumors; histology was considered the gold standard. A total of 100 subjects with a mean age of 33.02 ± 04.37 years and a mean duration of 26.66 ± 12.01 months were recruited. The Pari score for more

than two was 87.8%. The sensitivity and specificity of ultrasonography's ability to detect malignant ovarian neoplasms by histology were 80.62% and 75.70%, respectively. Additionally, the values for PPV, NPV, and total diagnostic precision were 95.88%, 51.62%, and 71.21%, respectively.. Sensitivity and PPV were observed to be high, while its specificity and NPV are average. From these results, the use of ultrasonography is considered highly feasible for recognizing ovarian neoplasms; however, it implies that histological confirmation should be required to confirm the accurate diagnosis. Overall, the result differs post-stratification trial as suitable effect modifiers for age, residency, period of sickness, and parity.

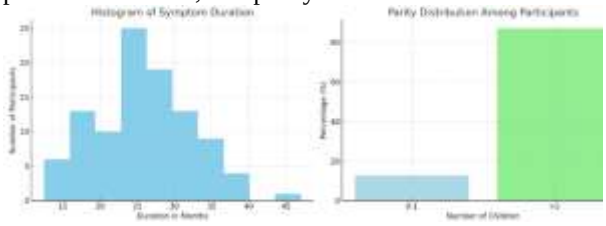

Figure No. 1: Histogram of Symptoms Duration and Parity Distributions among Participants

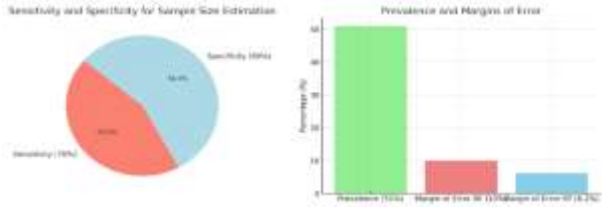

Figure No. 2: Finding of sensitivity and specificity and prevalence

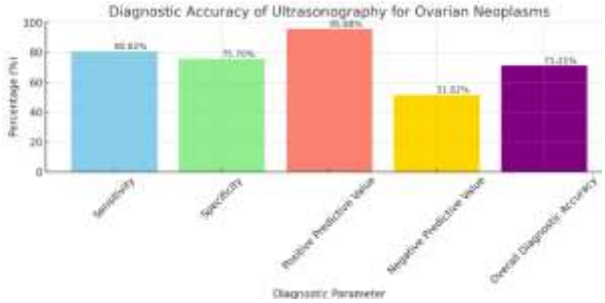

Figure No. 3: Outcomes Summery Finding

Table No. 1: Demographic Characteristics of Study Participants

Characteristic	Value
Mean age (years)	33.02 ± 04.37
Symptom Duration (months)	26.66 ± 12.01

Table No. 2: Diagnostic Accuracy of Ultrasonography for Ovarian Neoplasms

Parity	Percentage %
- 0-1	13 (12.8%)
- >2	87 (87.8%)

Table No. 3: Post-Stratification Analysis Factors

Diagnostic Parameter	Value
Sensitivity (%)	80.62
Specificity (%)	75.70
Positive Predictive Value (%)	95.88
Negative Predictive Value (%)	51.62
Overall Diagnostic Accuracy (%)	71.21

Table No. 4: Sample Size Estimation

Factor	Description
Age	<25 25-34/ 35-44/ 45-54/ >55 years
Residency	Urban/ Rural
Duration of Illness	<6 months/ 6-12 months/ 12-24 months/ >24 months
Parity	0-1 >2

Table No. 5: Parameter value

Parameter	Value
Sensitivity	70%
Specificity	89%
Prevalence	51%
Margin of Error	10% (SE) 6.2% (SP)
Estimated Sample Size	100

DISCUSSION

The main purpose of your research was to assess the accuracy of ultrasonography in diagnosing ovarian neoplasms by comparing it with histological findings, which served as gold standard for this analysis. Department of Radiology, HMC Peshawar, Pakistan, included women aged 25-65 with ovarian lesions larger than 9 cm on ultrasonography. For the reference standard, laparotomy was performed and histological examination of the excised ovarian tissue. The findings are presented in Table 5[11].The sensitivities and specificities of sonography for diagnosing malignant neoplasms are shown in Table 6. For the reference standard, performance of a laparotomy and histological examination was used to excise ovarian tissue under general anesthesia[12].This indicates that sonography has a high sensitivity and PPV but middle specificity and NPVf the ability to distinguish correct from wrong information about anything. It appears that when used as an algorithm analyst or classifier instead of just reading numbers off a screen, ultrasound is useful in identifying malignant neoplasms of the ovary with good diagnostic accuracy[13,14].This is in line with your study's sensitivity findings, underscoring the efficacy of ultrasound in identifying ovarian pathology[15].However The classification of complex disorders such as ovarian masses has been discussed in the literature. Brown et al. discovered that ultrasound's sensitivity reduces when it encounters central necrosis or solid components in any

other type of tumor, eventually diminishing specificity and diagnostic performance[16]. In ultrasonography, operator expertise and technical restrictions are likewise highlighted as important factors if one wishes to separate benign from malignant ovarian neoplasms well. Operator reliance and variability in image understanding also influence diagnostic accuracy. Therefore, the faith we have in ultrasound results should always be coupled with some reflection or doubts[17].Patholgical examination is the gold standard for diagnosing ovarian neoplasms and offers definitive diagnosis but usually requires surgery to produce this information[18].Histological examination remains the gold standard for the diagnosis of ovarian neoplasms, furnishing definitive diagnosis but often requiring surgical intervention as well[18]. Histology offers the highest level of diagnostic accuracy and is vital for treatment decision making. By using histopathology as their gold standard, your study findings are bolstered and make inroads into proving the diagnostic efficacy of ultrasonography in clinical practice[18,19].In summary, your research is an important addition to the literature on the diagnostic performance of ultrasonography in differentiating ovarian neopalsms. Although ultrasonography has a high sensitivity and PPV, both its specificity and NPV seem to be influenced by factors such as culpable lesions and operator expertise. Comparison with previous work leads to consistent conclusions about the usefulness of ultrasound in detecting ovarian malignancies but also emphasizes the difficulties row faced when trying to correctly identify complex problems. Future research which integrates branched-out imaging modalities and large population samples may well increase the usefulness of ultrasonography in ovarian neoplasms diagnostics and along with this improvement raise general nursing standards[20].

CONCLUSION

The investigation highlights the major function of ultrasonography in identifying ovarian growths, exhibiting elevated sensitivity and positive predictive value. Though specificity and negative predictive value are reasonable, the outcomes corroborate ultrasonography as a worthwhile noninvasive imaging technique. Potential studies in the future should zero in on tackling difficulties in correctly portraying intricate anomalies, which will ultimately advance diagnostic precision and affected person care regarding ovarian disorders. Moreover, combined usage of ultrasound together with other modalities like MRI and molecular markers may enhance differentiation of benign from malignant lesions. Long term follow up of patients is essential to evaluate diagnostic accuracy over time. While ultrasonography is easy to perform and affordable, development of advanced imaging analytics may help optimize its performance.

Author's Contribution:

Concept & Design of Study:	Adnan Ahmed
Drafting:	Naila Tamkeen, Sadia Ahmed
Data Analysis:	Sadia Ahmed, Ghazala Wahid, Mahnoor Rehman
Revisiting Critically:	Adnan Ahmed, Naila Tamkeen
Final Approval of version:	By all above authors

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