Diagnostic accuracy of ultrasound in differentiation of ovarian masses taking histopathology as gold standard

Hira Hammad[1], Anjum Tazeen[1], Syed Muhammad Yousaf Farooq[1].
[1] University Institute of Radiological Sciences and Medical Imaging Technology, The University of Lahore.

Corresponding: Syed Muhammad Yousaf Farooq

Abstract

Background: Females lifetime chance of developing an ovarian tumour is 6-7%. The relative prevalence of ovarian tumours varies across Western and Asian countries. The prompt and precise detection of ovarian masses has a significant influence on long-term survival.

Objective: To determine the diagnostic accuracy of ultrasound in differentiation of ovarian masses taking histopathology as gold standard.

Methodology: This analytical, cross-sectional study was conducted in Radiology Department of Lady Aitchison Hospital, Lahore. 209 females with ages between 20 and 65 years who had clinical sign and symptoms of abdominal pain, tenderness, abnormal uterine bleeding, post-menopausal bleeding, abdominal bloating or swelling, lower back pain, severe or sharp pelvic pain, fever, faintness or dizziness or subjects who had ovarian mass detected on ultrasound were included in the study. Pregnant females and patients with recent abdominal or pelvic surgery and patients with any detectable pathology other than ovarian were excluded from the study. Data was collected after taking consent. Trans abdominal and Doppler ultrasound was done on all subjects. On Ultrasound Consistency, Locularity, Papillary structures, Ascites and Vascularity of Ovarian masses were seen to differentiate between benign and malignant.

Results: According to the results mean and standard deviation of age was 37.36 ± 11.4 years. 174(83.3%) patients had benign ovarian masses whereas 35(16.7%) had malignant ovarian masses which were detected on ultrasound. According to the results, the sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value, and the Accuracy on ultrasound was 84.62%, 92.90%, 62.86%, 97.70%, and 91.87% respectively.

Conclusion: Study concluded that ultrasound is a reasonably accurate diagnostic tool for the diagnosis of ovarian masses. Overall, ultrasound can be a useful tool in the initial evaluation of ovarian masses, but it may need to be supplemented with additional diagnostic tests to confirm the diagnosis.

Key words: Ultrasonography, Histopathology, Ovarian cancer, ovarian cysts, Benign, Malignant.

Introduction

Ovarian tumor is the sixth most common cause of death in women, with a yearly incidence of 21,000 in 2015.[1] The unusually high ovarian tumor death rate is due to the fact that the majority of ovarian tumor patients are identified in late stages, when conventional treatment that appear to be less successful.[2] Patients with ovarian tumors have an exceedingly dismal outcome if cancer cells move to the abdominal cavity. The overall survival rate of ovarian tumor in patients at stage I is estimated to be 90%, which is much higher than the number for those in

advanced stages since tumor spread occurs seldom in stage I.[3] Ovarian cancer is a prevalent kind of malignant tumor in women. Its prevalence is growing, and it has a high fatality rate. Despite the fact that the majority of patients appear in the last stages, there is a prudent response to currently available chemotherapy and its usage in a multimodality scenario.[4] In numerous registries, the prevalence of ovarian cancer has steadily increased, and it has emerged as the third/fourth most prevalent cancer among females, but the major cause of mortality from any reproductive and gynecological malignancy.[5] That is even 3 times as deadly as breast cancer.[6] This high death rate with ovarian cancer is due to the fact that most cases appear at a mature phase because the illness has no particular signs.[7] According to the research, if they are found at an initial phases when they are confined to the ovary, more than 90% of such patients will live for more than 5 years.[8] Only a small percentage of these would generate clinical symptoms, few developing complications (torsion, bleeding, compression and rupture) and even fewer might becoming malignant, but in this situation, the mother's life might been endangered.[9,10] Histopathology is thought to be the gold standard for detecting and diagnosing ovarian mass diseases. Ovarian neoplasms are frequent, however only a small percentage of them are cancerous. It is difficult to distinguish between malignant and benign ovarian tumors since there are presently no diagnostic techniques sensitive enough to distinguish between the two without producing a significant proportion of false positive findings. [11] Although histopathology is considered as the gold standard for the final diagnosis of ovarian masses, ultrasound has always been the first line modality for detection of these lesions. It is also a non-invasive, and safe option. With the passage of time improvements in technology and consequently better resolution and development of various criteria based on sonographic findings has increased the role of ultrasound in determining the type of ovarian masses. This study intends to further assess the functionality of ultrasound in distinguishing benign from cancerous ovarian tumours by correlating the sonographic findings with histopathological diagnosis. This correlation can thus help in timely diagnosis and management of these masses.

Methodology

This analytical, cross-sectional study was held in Radiology Department of Lady Aitchison Hospital, Lahore. 209 females with ages between 20 and 65 years who had clinical sign and symptoms of abdominal pain, tenderness, abnormal uterine bleeding, post-menopausal bleeding, abdominal bloating or swelling, lower back pain, severe or sharp pelvic pain, fever, faintness or dizziness or subjects who have an ovarian mass detected on ultrasound were part of the research. Pregnant females and patients with recent abdominal or pelvic surgery and patients with any detectable pathology other than ovarian were excluded from the study. Data was collected after the consent form. Trans abdominal and Doppler ultrasound was done on all subjects. On Ultrasound Consistency, Locularity, Papillary structures, Ascites and Vascularity of Ovarian masses were seen to differentiate between benign and malignant.

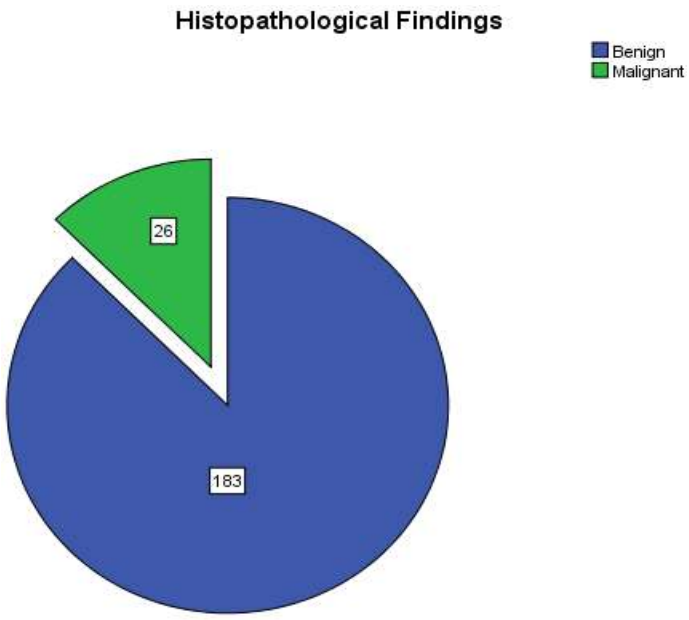
Result

A total of 209 female patients were included in this study. The Mean and standard deviation of age of the subjects was 37.36 ± 11.4 years.

Table 1: Trans abdominal and Doppler ultrasound findings

Trans abdominal and Doppler Findings	Frequency and Percentages
Consistency	
Cystic	99 (47.4%)
Mixed	110 (52.6%)
Locularity	
Multilocular	57 (27.3%)
Unilocular	152 (72.7%)
Papillary structures	
Present	25 (12%)
Absent	184 (88%)
Ascites	
Present	32 (15.3%)
Absent	177 (84.7%)
Vascularity	
minimal vascularity	35 (16.7%)
Present	5 (2.4%)
Absent	169 (80.9%)

According to table 1: On ultrasound 99(47.4%) masses had cystic consistency, and 110(52.6%) masses had mixed consistency. 57(27.3%) masses were multilocular and 152(72.7%) masses were unilocular. In 184(88.0%) masses papillary structures were not present whereas in 25(12.0%) masses the papillary structures were present. 177(84.7%) masses had no ascites and 32(15.3%) had ascites. 35(16.7%) masses had minimal vascularity whereas in 169(80.9%) masses vascularity was not seen. In 5(2.4%) masses vascularity was seen.



Graph 1: Assessment on Histopathology of ovarian masses

183(87.6%) masses were benign, and 26(12.4%) masses were malignant ovarian masses.

Table 2: Sonographic findings * Histopathological Findings Cross tabulation.

Sonographic findings * Histopathological Findings		Histopathological Findings		Total	Chi-square test
		Malignant	Benign		
Ultrasound findings	Malignant	22	13	35	.000
	Benign	4	170	174	
Total		26	183	209	

According to table 2: Out of 209 ovarian masses, 170 were benign on Ultrasound and histopathology, 22 were malignant on both. Chi-square test proves significant association between Ultrasound and histopathological findings.

Table 3: Diagnostic accuracy of Ultrasound for the diagnosis of Ovarian masses

Statistic	Value	95% CI
Sensitivity	84.62%	65.13% to 95.64%
Specificity	92.90%	88.16% to 96.16%
Disease prevalence (*)	12.44%	8.29% to 17.69%
Positive Predictive Value (*)	62.86%	49.43% to 74.56%
Negative Predictive Value (*)	97.70%	94.52% to 99.05%
Accuracy (*)	91.87%	87.30% to 95.19%

According to table 3: The sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value, and the Accuracy on ultrasound were 84.62%, 92.90%, 62.86%, 97.70%, and 91.87% respectively.

Discussion

Ovarian tumor is the sixth most common cause of death in women, with a yearly frequency of 21,000 in 2015.[1] The unusually high ovarian tumor death rate is due to the fact that the majority of ovarian tumor patients are identified in later stages, when traditional therapies appear to be less successful.[2] That is even 3 times as deadly as breast cancer.[6]

209 patients in total were included in this study. The data analysis revealed that the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy on ultrasonography were 84.62%, 92.90%, 62.86%, 97.70%, and 91.87% respectively. In a study done by Parikshaa Gupta in 2001, the sensitivity, specificity, positive and negative predictive values and diagnostic accuracy for diagnosing ovarian masses were 88.4%, 85.7%, 96.8%, 60.0% and 88% respectively. Risk of malignancy for each category was 80%, 0%, 4.5%, 66.7%, 88.5% and 98.5% respectively.[12]

In this study, the sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value, and the Accuracy on ultrasound were 84.62%, 92.90%, 62.86%, 97.70%, and 91.87% respectively. In a retrospective study by Saima Hafeez[13], Ovarian cancer is the second most frequent cancer among Pakistani women, accounting for 4% of all female cancers. Retrospective results showed that the sensitivity and specificity of ultrasonography were 90.7% (95% CI 0.77, 0.97) and 91.4% (0.76, 0.98), respectively.

In this study, 174 (83.3%) patients had benign, and 35 (16.7%) patients had malignant ovarian masses. In a study done by R Jha and S Karki, Ovarian tumors were benign in 83.9% of cases and malignant in 16.1%. This matches the findings from Western nations, where 75.0-80.0% of ovarian cancers are benign.[14] Similarly, a research conducted in India by Pilli et al[15] found that 75.2% of ovarian tumors were benign, whereas this proportion was only 59.2% in a study conducted in Pakistan by Ahmad et al.[16]

Ultrasound can be used for early diagnosis, monitoring the patient and for assessing a son-morphological score, as it is easy to use, safe and has high sensitivity and sensibility. Different researchers established sonographic features characteristic for the different types of adnexal masses discovered, having by this an important role in distinguishing benign masses from malignancies.[17, 18, 19]

In this study, 35(16.7%) patients had minimal vascularity whereas in 169(80.9%) patients' vascularity was not seen. In 5(2.4%) patients' vascularity was seen. The location of tumor vascularity in Doppler investigations does not alter the diagnosis of cystic neoplasm since tumor vascularity is met approximately equally throughout the wall. If the tumor is solid, benign nodules generally have more peripheral vascularity than malignant nodules, which have more central vascularity.[21]

In this study, in 184(88.0%) patients, papillary structures were not present whereas in 25(12.0%) patients the papillary structures were present. Sonographic assessment of ovarian masses is based on size, outer curves, consistency, and secondary signs of malignancy such as ascites and peritoneal implants, and it correlates morphologic images with macroscopic tumor pathologic features such as nonfatty solid tissue, thick septations, and papillary projections.[22]

Conclusion

Study concluded that ultrasound is a reasonably accurate diagnostic tool for the diagnosis of ovarian masses. The accuracy of ultrasound in diagnosing ovarian masses was 91.87%. Overall,

ultrasound can be a useful tool in the initial evaluation of ovarian masses, but it may need to be supplemented with additional diagnostic tests to confirm the diagnosis.

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