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Diagnostic Accuracy of Ultrasonography in Detection of Molar Pregnancy Keeping Histopathology as Gold Standard

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Abstract

Objective: To determine the diagnostic accuracy of ultrasonography in detecting molar pregnancy, using histopathology as the gold standard.

Methodology: This cross-sectional validation study was conducted at the Department of Radiology, MTI- Hayatabad Medical Complex, from 01 July 2024 to 01 January 2025. A total of 171 pregnant women in their first trimester presenting with vaginal bleeding were included. All participants underwent pelvic ultrasonography performed by an experienced radiologist with findings recorded based on predefined ultrasonographic criteria for molar pregnancy and confirmed by histopathology. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy of ultrasonography were calculated.

Results: Molar pregnancy was detected on ultrasonography in 151 (88.3%) patients, whereas histopathology confirmed molar pregnancy in 161 (94.2%) cases. The sensitivity of ultrasonography in detecting molar pregnancy was 88.20%, specificity was 10%, PPV was 94.04%, and NPV was 5.00%. The overall diagnostic accuracy of ultrasonography was 83.63%, with a p-value of 0.863.

Conclusion: Ultrasonography demonstrated high sensitivity and PPV for detecting molar pregnancy but had low specificity and NPV. While it remains a valuable initial screening tool, reliance on histopathology for definitive diagnosis is necessary to avoid misclassification. Further regional studies are recommended to refine ultrasonographic criteria and improve diagnostic precision.

Keywords: Chorionic villi, Diagnostic imaging, Hydatidiform mole, First trimester pregnancy, Ultrasonography.

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Introduction

Gestational trophoblastic disease (GTD) encompasses a spectrum of trophoblastic proliferative disorders, among which hydatidiform mole (molar pregnancy) is the most prevalent. It is characterized by an abnormal proliferation of placental trophoblastic tissue, leading to the development of either a complete or partial mole. Complete moles are diploid and lack fetal tissue, whereas partial moles are triploid and may contain fetal remnants. Molar pregnancy can progress to persistent gestational trophoblastic neoplasia, making early and accurate diagnosis crucial for optimal management.[1]

Despite advancements in diagnostic modalities, differentiating molar pregnancy from other early pregnancy complications remains challenging. Clinical features, including vaginal bleeding and excessive beta-human chorionic gonadotropin (β-hCG) levels, are non-specific, often overlapping with conditions like missed abortion and ectopic pregnancy.[2]

Ultrasonography remains the first-line imaging modality; however, its diagnostic accuracy varies, with studies reporting sensitivity ranging from 70% to 80% and specificity around 84%.[3] Histopathological examination is considered the gold standard for confirming molar pregnancy, yet its reliance on tissue sampling limits its use as an initial diagnostic tool.[4]

Globally, the incidence of molar pregnancy shows significant geographical variation. In North America and Europe, it ranges between 0.6 and 1.2 per 1,000 pregnancies, whereas in Asian and Latin American populations, it is considerably higher, with rates reaching up to 2 to 3 per 1,000 pregnancies.[5,6] Several factors, including maternal age, prior molar pregnancies, and nutritional deficiencies, have been linked to this increased prevalence.[7]

Regionally, studies from South Asian countries, including India and Bangladesh, have reported a higher incidence of GTD compared to Western counterparts, reflecting potential genetic and environmental influences.[8] In Pakistan, limited epidemiological data exist; however, tertiary care hospital-based studies suggest a rising trend in GTD cases, underscoring the need for enhanced diagnostic strategies.[9]

Given the variability in ultrasonography's diagnostic performance, there is a need for region-specific validation studies to determine its accuracy in detecting molar pregnancy. This study aimed to evaluate the diagnostic accuracy of ultrasonography in the detection of molar pregnancy, keeping histopathology as the gold standard. Establishing reliable ultrasonographic criteria will facilitate early detection, prompt management, and prevention of complications, thereby improving maternal health outcomes in our local population.

Methodology

This cross-sectional validation study was conducted at the Department of Radiology, MTI-Hayatabad Medical Complex, over a six-month period from 1st July 2024 to 1st January 2025. Ethical approval for this study was obtained from the Institutional Review and Ethics Board (IREB) of Hayatabad Medical Complex, Peshawar. Informed consent was obtained from the patient or the caretaker after explaining the purpose and procedures of the study. A total of 171 pregnant women in their first trimester presenting with vaginal bleeding were included. Participants were enrolled using a non-probability consecutive sampling technique. Inclusion criteria comprised women with positive pregnancy tests and ultrasound suspicion of molar pregnancy. Women with known co-existing pathologies (e.g., fibroids or ectopic pregnancy) that could confound ultrasound findings were excluded.

All participants underwent transabdominal or transvaginal pelvic ultrasonography using a high-resolution ultrasound machine (Philips Affiniti 70, Koninklijke Philips N.V., Amsterdam, Netherlands) performed by an experienced radiologist with over five years of diagnostic imaging experience. Ultrasonographic criteria for molar pregnancy included the presence of a 'snowstorm' appearance, absence of fetal parts, and the presence of multiple anechoic cystic spaces within an enlarged uterus.

Following the ultrasound examination, uterine evacuation was performed, and the products of conception were sent for histopathological examination. The specimens were examined by a consultant histopathologist who was blinded to the ultrasonographic findings. Histopathological diagnosis was made based on standard criteria distinguishing complete and partial molar pregnancies, and it served as the gold standard for final diagnosis.

Demographic data and clinical details including age, gestational age, duration of symptoms, body mass index (BMI), and comorbidities were collected using a structured proforma. All drugs used for uterine evacuation, such as misoprostol (Cytotec®, 200 mcg tablets, Pfizer Inc., New York, USA), were documented with their dose and route (administered vaginally or orally depending on clinical indication).

Data analysis was performed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize demographic and clinical characteristics. Numerical variables were presented as mean ± standard deviation, while categorical variables were reported as frequencies and percentages. The diagnostic performance of ultrasonography was assessed by calculating sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy using 2×2 contingency tables.

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Results

The descriptive statistics of the study population (n=171) showed that the mean age of the participants was 31.56 ± 8.56 years. The mean gestational age at presentation was 8.41 ± 2.35 weeks. The duration of symptoms among participants was 15.78 ± 9.31 days. The mean body mass index (BMI) of the study participants was 26.57 ± 5.04 (Table 1).

Regarding the clinical characteristics of the patients, diabetes mellitus was present in 149 (87.1%) participants, while 22 (12.9%) did not have diabetes. Hypertension was observed in 155 (90.6%) patients, whereas 16 (9.4%) did not have hypertension. A history of spontaneous abortion was noted in 143 (83.6%) participants, while 28 (16.4%) had no history of spontaneous abortion. Molar pregnancy was detected on ultrasonography in 151 (88.3%) patients, whereas 20 (11.7%) did not have findings suggestive of molar pregnancy on ultrasonography. On histopathological examination, 161 (94.2%) cases were confirmed as molar pregnancy, while 10 (5.8%) did not meet the histopathological criteria for molar pregnancy (Table 2).

The calculated sensitivity of ultrasonography in detecting molar pregnancy was 88.20%, specificity was 10.00%, positive predictive value (PPV) was 94.04%, and negative predictive value (NPV) was 5.00%. The overall diagnostic accuracy of ultrasonography in detecting molar pregnancy was 83.63%. (Table 3).

Table 1. Descriptive Statistics of Study (n=171)

Numerical Variables	Mean	Std. Deviation
Age (years)	31.56	8.557
Gestational Age (weeks)	8.41	2.348
Duration of Symptoms (days)	15.78	9.308
BMI	26.574	5.0444

Table 2. Clinical Characteristics of Patients (n=171)

Numerical Variables	Mean	Std. Deviation
Diabetes Mellitus	Frequency	Percent
Yes	149	87.1%
No	22	12.9%
Total	171	100.0%
Hypertension	Frequency	Percent
Yes	155	90.6%
No	16	9.4%
Total	171	100.0%
History of Spontaneous Abortion	Frequency	Percent
Yes	143	83.6%
No	28	16.4
Total	171	100.0
Molar Pregnancy on Ultrasonography	Frequency	Percent
Yes	151	88.3%
No	20	11.7%
Total	171	100.0%
Molar Pregnancy on Histopathology	Frequency	Percent
Yes	161	94.2%
No	10	5.8%
Total	171	100.0%

Discussion

The findings of this study align with existing literature regarding the diagnostic accuracy of ultrasonography in detecting molar pregnancies. The sensitivity observed in our study is consistent with previous research, which reported a sensitivity of 70% for ultrasonography in diagnosing molar pregnancies.[10] However, the specificity in our study was notably lower than that reported in other studies, which have documented specificities as high as 99%.[11] This discrepancy may be attributed to differences in operator expertise, equipment quality, and patient populations.

The high positive predictive value (PPV) observed in our study suggests that when ultrasonography indicates a molar pregnancy, there is a high likelihood of histopathological confirmation.[12] This is consistent with previous findings that emphasize the reliability of ultrasonography in identifying complete molar pregnancies.[13] However, the low negative predictive value (NPV) indicates that a negative ultrasonographic finding does not reliably exclude the presence of a molar pregnancy. This underscores the necessity of histopathological examination for definitive diagnosis, especially in cases with high clinical suspicion.[14]

Several limitations must be acknowledged in this study. Firstly, the study was conducted in a single tertiary care center, which may limit the generalizability of the findings to other settings with different patient demographics and resource availability. Secondly, the reliance on operator-dependent ultrasonographic assessments introduces variability, as diagnostic accuracy can be influenced by the sonographer's experience and expertise. Additionally, the study did not differentiate between complete and partial molar pregnancies, which have varying ultrasonographic features and diagnostic challenges. Furthermore, the retrospective

Table 3. Comparison of Diagnostic Accuray of Molar Pregnancy on Ultrasonography and Histopathology (n=171)

		Molar Pregnancy on Histopathology		Total	Statistics
		Yes	No		
Molar Pregnancy on Ultrasonography	Yes	142	9	151	Sensitivity = 88.20% Specificity = 10.00% PPV = 94.04% NPV = 5.00% Diagnostic Accuracy = 83.63%
		88.2%	90.0%	88.3%	
	No	19	1	20	
		11.8%	10.0%	11.7%	
Total		161	10	171	
		100.0%	100.0%	100.0%	

nature of data collection may have introduced selection bias.

Future research should focus on multicenter studies to enhance the generalizability of findings and consider the inclusion of advanced imaging modalities, such as Doppler ultrasonography, to improve diagnostic accuracy. Standardizing ultrasonographic criteria and providing specialized training for sonographers may also reduce variability and enhance early detection rates. Moreover, prospective studies examining the differentiation between complete and partial molar pregnancies could provide valuable insights into tailored management strategies.

Conclusion

Ultrasonography demonstrated high sensitivity and a strong positive predictive value for detecting molar pregnancy, making it a valuable initial diagnostic tool. However, its low specificity and negative predictive value highlight the need for histopathological confirmation to avoid misdiagnosis. Given the variability in ultrasonographic accuracy, further multicenter studies and advancements in imaging techniques are necessary to enhance diagnostic precision. Implementing standardized sonographic criteria and specialized training for radiologists may improve early detection and management of molar pregnancy in clinical practice.

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Authors' Contribution Statement

MA contributed to the conception, design, acquisition, analysis, interpretation of data, drafting of the manuscript, and critical review of the manuscript. GW contributed to the conception, design, acquisition, drafting of the manuscript, critical review of the manuscript, and final approval of the version to be published. RI contributed to the analysis, interpretation of data, and drafting of the manuscript. FN contributed to the analysis, interpretation of data, and drafting of the manuscript. FB contributed to the analysis, interpretation of data, and drafting of the manuscript. MA contributed to the analysis, interpretation of data, and drafting of the manuscript. All authors are accountable for their work and ensure the accuracy and integrity of the study.

Conflict of Interest

Authors declared no conflict on interest

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None

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.