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Comparative Diagnostic Accuracy of Ultrasonography and Magnetic Resonance Imaging in Characterizing Uterine Adnexal Masses: A Prospective Study with Histopathological Correlation

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Abstract: ***Background: Adnexal masses pose diagnostic challenges due to their varied etiology and potential for malignancy. Ultrasonography (USG) and magnetic resonance imaging (MRI) are widely used, but their comparative accuracy remains debated. Objective: To evaluate the sensitivity, specificity, and overall accuracy of USG and MRI in differentiating benign from malignant adnexal masses using histopathology (HPE) as the gold standard. Methods: A prospective study of 60 patients with adnexal masses (>5 cm) at Rama Medical College (2022–2024). All underwent trans - abdominal USG, contrast - enhanced MRI (1.5T GE), and HPE. Statistical analysis included ROC curves, PPV/NPV, and SPSS v25. Results: MRI demonstrated superior sensitivity (91.7% vs.58.3%) and NPV (97.1% vs.86.8%) compared to USG, with both modalities showing 100% specificity and PPV. MRI's AUC (0.958) surpassed USG (0.792). Benign serous cyst adenoma (33.3%) and mucinous cystadenocarcinoma (16.7%) were common findings. Conclusion: MRI outperforms USG in characterizing complex adnexal masses, particularly for malignancy detection. It should be prioritized when USG results are inconclusive.***

Keywords: adnexal masses, MRI accuracy, ultrasonography comparison, malignancy detection, diagnostic imaging

1. Introduction

Adnexal masses, arising from structures near the uterus, are a key focus in gynecology due to their diagnostic and therapeutic challenges. These masses can be benign or malignant, with ovarian neoplasm often detected at advanced stages, complicating treatment. The etiology varies by age, with benign masses more common in younger patients and malignancies more frequent in older cohorts.

Given the rising incidence and mortality of ovarian cancer, there is a pressing need for improved diagnostic and treatment strategies. Imaging techniques like ultrasonography, CT, and MRI play a crucial role, with MRI offering advantages in precision and non - invasiveness. Ultrasonography is particularly effective in detecting and characterizing adnexal masses.

Treatment strategies depend on disease stage, age, and symptoms, often involving surgery, chemotherapy, and, in some cases, hormonal therapy. This study aims to deepen the understanding of adnexal masses, emphasizing imaging techniques and histopathological correlations to enhance diagnostic accuracy and therapeutic effectiveness. The ultimate goal is to advance patient outcomes and reduce ovarian cancer - related morbidity.

2. Materials and Methods

This prospective study will be conducted at Rama Medical College Hospital and Research Centre, Kanpur, from August 2022 to February 2024, involving 60 purposively selected individuals with lower abdominal pain and menstrual irregularities. Ethical approval will be obtained before the study begins, and participants will provide written or verbal consent. Data will be collected using a standardized proforma, including patient profiles, clinical history, and

imaging findings (USG, MRI, and HPE). Analysis will be performed using SPSS v25 or MS Excel.

Inclusion Criteria:

Simple adnexal cysts > 5 cm

Complex adnexal lesions

Exclusion Criteria:

Simple adnexal cysts < 5 cm

Ectopic pregnancy

Ovarian torsion

Patients contraindicated for MRI (e. g., pacemakers, metallic implants)

3. Results

The study analyzed data from 60 female patients with lower abdominal pain and menstrual irregularities using IBM SPSS Statistics (version 23.0). Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used. ROC curve analysis was conducted to compare the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of ultrasound (USG) and magnetic resonance imaging (MRI) against histopathological examination (HPE).

Table 1: Descriptive Statistics of Study Population

Characteristic	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	60	16	76	37.64	12.617
Thickness (USG) (mm)	34	2	4	2.992	0.5699
Resistive Index (USG)	36	0.4	0.9	0.6844	0.16173
Thickness (MRI) (mm)	34	2	4	3.304	0.5674
Valid N (listwise)	34				

USG VS MRI Septal thickness characteristics: The evaluation of septal thickness greater than 3 mm and less than 3 mm across USG, MRI, and HPE is crucial in diagnosing adnexal lesions.

Table 15: Septal Thickness Characteristics

Imaging Modality	Septal Thickness > 3 mm	Percentage (%)	Septal Thickness < 3 mm	Percentage (%)
USG	12	20.0	48	80.0
MRI	14	23.3	46	76.7
HPE	16	26.7	44	73.3

Table 16: Cross - tabulation of USG results against HPE findings

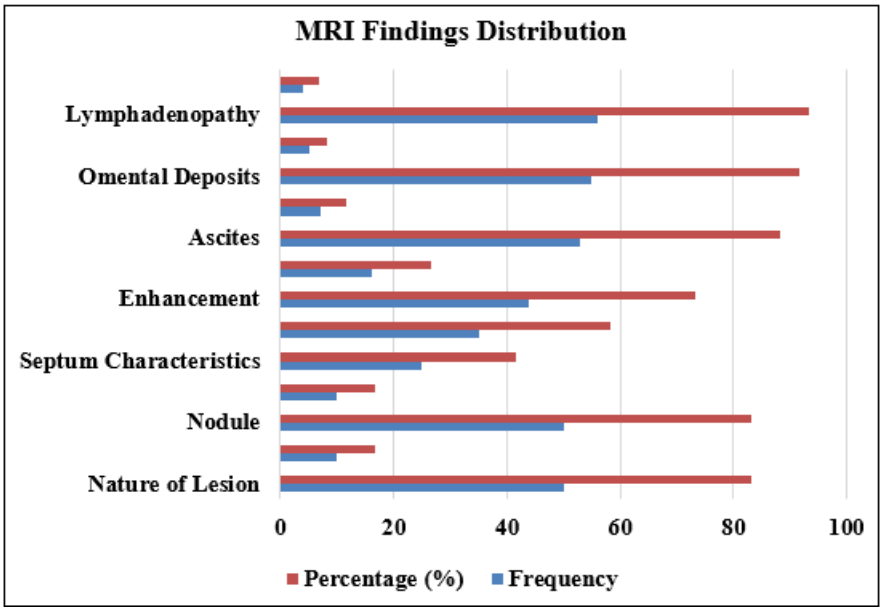
USG Results /HPE Results	Positive (+ ve)	Negative (- ve)	Total
Positive (+ ve)	10	2	12
Negative (- ve)	8	40	48
Total	18	42	60

Table 17: Cross - tabulation of MRI results against HPE findings.

MRI Findings/ HPE Results	Positive (+ ve)	Negative (- ve)	Total
Positive (+ ve)	17	0	17
Negative (- ve)	3	40	43
Total	20	40	60

Statistical Performance: | Metric | USG (%) | MRI (%) |

Variable	USG **(%)**	MRI **(%)**
Sensitivity	58.3	91.7
Specificity	100	100
PPV	100	100
NPV	86.8	97.1
Overall Accuracy	79.15	95.8



ROC Curve Analysis

The ROC curve analysis provides an understanding of the diagnostic ability of USG and MRI. The area under the curve (AUC) indicates the overall performance of the test; the closer the AUC is to 1, the better the test.

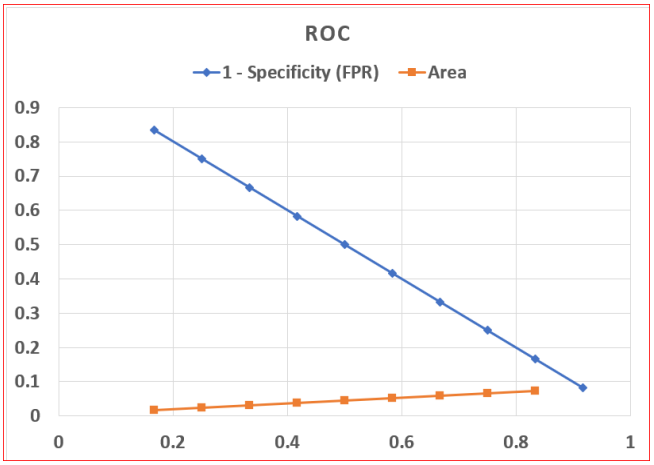


Figure 4: ROC curve analysis

Table 19: ROC curve analysis for USG and MRI.

Test Result Variable (s)	Area	Std. Error	Asymptomatic Sig.	95% Confidence Interval
USG	0.792	0.092	0.003	0.611 - 0.973
MRI	0.958	0.047	0.000	0.866 - 1.000

The AUC values for USG and MRI are 0.792 and 0.958, respectively. This indicates that MRI has a higher diagnostic performance compared to USG.

Age Range Distribution

Table 20: Distribution of patients by age range.

Age Range	Frequency	Percent
Up to 25 years	10	16.7
26 - 35 years	15	25.0
36 - 45 years	18	30.0
46 - 55 years	10	16.7
Above 55 years	7	11.7
Total	**60**	**100.0**

The majority of the patients fall within the age range of 36 - 45 years, accounting for 30% of the total sample size.

4. Discussion

This study evaluates the diagnostic performance of ultrasound (USG) and magnetic resonance imaging (MRI) in characterizing ovarian tumors, comparing their sensitivity, specificity, and correlation with histopathological examination (HPE) findings.

Key Findings

- Diagnostic Performance: MRI demonstrated superior sensitivity (91.7%) compared to USG (58.3%), while both modalities had 100% specificity and positive predictive value (PPV). MRI also had a higher negative predictive value (NPV) (97.1%) than USG (86.8%), making it more reliable for ruling out disease.
- ROC Curve Analysis: MRI showed a higher area under the curve (AUC) (0.958) than USG (0.792), reinforcing its superior diagnostic accuracy.
- Tumor Characterization: Benign ovarian tumors were more prevalent than malignant ones, with MRI effectively detecting complex structures like solid - cystic lesions and thick septations.
- Clinical Implications: Given its superior resolution and contrast, MRI is recommended when USG findings are inconclusive, aiding in surgical planning and reducing unnecessary surgeries. Its high specificity also minimizes invasive procedures for benign cases.
- Age Distribution: Benign ovarian cysts were more common in younger women, while malignancies were more frequent in postmenopausal women, aligning with epidemiological trends.
- Comparison with Literature: Findings align with existing studies emphasizing MRI's role as a second - line tool after USG, particularly in complex adnexal masses.

5. Limitations & Future Directions

A larger sample size and integration of artificial intelligence in imaging analysis could further improve diagnostic accuracy and personalized patient care.

MRI outperforms USG in diagnosing ovarian masses, making it the preferred imaging modality for complex adnexal lesions.

6. Conclusion

This study highlights the crucial role of MRI in evaluating ovarian adnexal masses, particularly when USG results are inconclusive. MRI demonstrated superior sensitivity (91.7% vs.58.3% for USG) while maintaining equal specificity (100%), making it highly effective in distinguishing between benign and malignant ovarian lesions.

Key Findings:

- Diagnostic Superiority: MRI's higher AUC (0.958 vs.0.792 for USG) confirms its superior ability to differentiate between benign and malignant masses.
- Clinical Relevance: MRI enhances preoperative planning, reducing unnecessary surgeries and improving patient management. Its high specificity and PPV also help reassure patients with benign lesions.
- Age & Tumor Distribution: The study aligns with epidemiological trends, showing a higher prevalence of benign tumors in younger women and malignancies in postmenopausal women.
- Strategic Use: Given its cost and limited availability, MRI should be used as a second - line modality when USG findings are indeterminate.

7. Future Directions

Further research should focus on refining diagnostic protocols, integrating emerging technologies like AI, and combining USG and MRI findings to enhance diagnostic accuracy. While USG remains the first - line imaging tool, MRI's advanced capabilities ensure its continued importance in managing complex ovarian lesions, ultimately improving patient outcomes.

References

[1] Wheeler, V., B. Umstead, and C. Chadwick, *Adnexal Masses: Diagnosis and Management.* Am Fam Physician, 2023.**108** (6): p.580 - 587.

[2] Carvalho, J. P., R. Moretti - Marques, and A. Filho, *Adnexal mass: diagnosis and management.* Rev Bras Ginecol Obstet, 2020.4**2** (7): p.438 - 443.
[3] Huang, J., et al., *Worldwide Burden, Risk Factors, and Temporal Trends of Ovarian Cancer: A Global Study.* Cancers (Basel), 2022.1**4** (9).
[4] Sohaib, S. A., et al., *The role of magnetic resonance imaging and ultrasound in patients with adnexal masses.* Clin Radiol, 2005.6**0** (3): p.340 - 8.
[5] Karakaya, B. K., et al., *Evaluation of Probably Benign Adnexal Masses in Postmenopausal Women.* Rev Bras Ginecol Obstet, 2017.3**9** (5): p.229 - 234.
[6] Coleridge, S. L., et al., *Chemotherapy versus surgery for initial treatment in advanced ovarian epithelial cancer.* Cochrane Database Syst Rev, 2021.2 (2): p. Cd005343.
[7] Rai, R., P. C. Bhutia, and U. Tshomo, *Clinicopathological profile of adnexal masses presenting to a tertiary - care hospital in Bhutan.* South Asian J Cancer, 2019.8 (3): p.168 - 172.