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ORIGINAL ARTICLE

Evaluation and characterization of pelvic masses of gynecological origin by ultrasonongraphy and MRI reproductive age group.

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ABSTRACT… Objective: To diagnostic accuracy of ultrasonongraphy and MRI for characterization of pelvic masses of gynecological origin in reproductive age group, with histopathology acting as the gold standard. **Study Design:** Cross-sectional. **Setting:** Department of Radiology, PAF Hospital Islamabad. **Period:** April 25th, 2021, to October 25th, 2021. **Methods:** In this investigation, non-probability consecutive sampling was utilized to collect data. A total of 220 women with pelvic mass were included in the study. Data regarding characterization of pelvic masses (malignant/benign) form ultrasound/MRI and histopathology was noted as per operational definition. **Results:** The study included participants aged 18-50, with a mean age of 31.6135.70 years, a mean parity of 3.130+1.37, and a mean duration of complaints of 7.186 +2.10 weeks. Ultrasound has shown sensitivity of 75.5%, specificity 88.8% and diagnostic accuracy by 83.2%, PPV 69% and NPV 88.3%. MRI has shown sensitivity of 83%, specificity 93.7% and diagnostic accuracy by 91%, PPV 83% and NPV 93.7% in characterization of pelvic masses. **Conclusion:** When sonographic characteristics of a pelvic tumor are inconclusive, MRI should be investigated for pathology investigation.

Key words: Diagnostic Accuracy, Histopathology, MRI, Pelvic Mass, Ultrasound.

INTRODUCTION

Since the 1970s, radiologists have been using magnetic resonance imaging (MRI).[1] Comparatively, MRI is superior to CT and ultrasound in several ways. The capacity to perform multiplanar imaging is another selling point for magnetic resonance imaging. The third benefit of MRI is the high quality of the tissue differentiation it provides. MRI's innate sensitivity to blood flow is the fourth benefit of using this technology. MRI can detect anomalies in the arterial and venous systems.[1]

Throughout the past decade, MRI's role in diagnosing utero-ovarian lesions has grown significantly. These growing symptoms have numerous motivating factors. To begin, MR hardware and software solutions that enable the everyday capture of images with high spatial or temporal resolution have proliferated widely in recent years.[2] Finally, in this age of cost restraint, various studies have indicated that the judicious use of MR imaging in the diagnostic algorithm minimizes cost, which is especially important given the increasing prevalence of minimally invasive therapies for the therapy of gynecologic problems.[2] Infertility, congenital malformations[3], ovarian and cervical lesions, pelvic inflammatory illness, etc. are all reasons to have an MRI of the female genital system performed.

When evaluating utero-ovarian lesions in adult females, magnetic resonance imaging (MRI) of the pelvis is a reliable method that is frequently utilized in conjunction with ultrasonography. Magnetic resonance imaging (MRI) has largely replaced the necessity for diagnostic surgical intervention in the characterization of congenital Mullerian abnormalities.[4]

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Staging gynecologic cancers with MRI is gaining popularity.[5] Ovarian cancer is the most lethal form of gynecologic malignancy and the second most prevalent pelvic tumor.[5] Patients with ovarian cancer can use MRI to determine the extent of their disease, which can then be used as a surgical guide or to rule out patients who are not resectable. Women with cervical or endometrial cancer can benefit from MRI staging in addition to clinical and surgical methods.[5,6]

Usmani Y, et al. found that when comparing MRI and ultrasound for the characterization of adnexal masses, MRI has a sensitivity of 75% and a specificity of 93.9%, whereas ultrasound has a sensitivity of 75% and a specificity of 93.7%.[7] In a study by Sultana N, et al. has shown that prevalence of benign lesions was 60.6 % while 39.3 % were malignant lesions.[8] Another study by Mohamed DM, et al. shows that ultrasonography may characterize adnexal masses with a sensitivity of 67.25 and a specificity of 75.[9]

A pelvic tumor that looks suspicious on USG may turn out to be a benign lesion on MR, saving the patient from unnecessary invasive procedures. When a pelvic lesion remains unclear after being examined with gray-scale ultrasonography, magnetic resonance imaging (MRI) is the most helpful modality. Consequently, the study will be conducted to evaluate the efficacy of ultrasonography and MRI in diagnosing pelvic masses, with histology serving as the gold standard.

METHODS

The objective of this research is to use ultrasonography and magnetic resonance imaging to characterize pelvic malignancies, with histopathology acting as the gold standard. This study used a cross-sectional validation approach. This investigation took place at the Radiology Department of the PAF Hospital in Islamabad. Research was conducted from April 25th, 2021, to October 25th, 2021. In this investigation, non-probability consecutive sampling was utilized to collect data.

Both unmarried and married women between the ages of 18 and 50 are welcome to take part. A pelvic mass was identified clinically, and the patient was referred for further characterization. Patients who have had a biopsy and histology performed, post-operative patients, patients with claustrophobia, pregnant women who have had an ultrasound, and patients who have had a H/o hypersensitive reaction are not included in the Criteria.

After receiving approval from the institutional review board (ERC/108/02/2021), patients meeting the inclusion criteria were recruited from the Department of Radiology at the Pakistan Air Force Hospital in Islamabad. Patients' marital status, number of children, and length of complaint were recorded as a baseline. The patients gave their consent after being assured of their privacy and the lack of danger in taking part in the trial.

The surgical and pathologic results were kept secret while the MR pictures were analyzed. Number of masses, lesion origin (ovarian, tubal, tubo-ovarian, or extra ovarian), lesion form, lesion size, and lesion content were all recorded as part of the imaging findings (solid only, complex solid–cystic, and cystic only). If a wall and internal septae could be located, information about its depth, make-up, and enhancement was recorded. Number, thickness, smoothness, and irregularity of the septa, as well as their augmentation, were all noted. The size of any plants growing on the lesion's lining or septum was recorded. T2-weighted MR scans also revealed tissues with low signal intensity (e.g., signal intensity of skeletal muscle). Fibrous tissue is characterized by a low signal intensity. When possible, MRI and postoperative histological findings were analyzed before or after USG was performed.

According to the operational definition, data was recorded on a specially prepared proforma about the characterization of pelvic masses (malignant/benign) based on ultrasound/MRI and histopathology. IBM-SPSS 23 was used for data entry and analysis. For each quantitative variable (such as age, parity, or length of complaint), the mean and standard deviation were computed. Quantitative data was converted into frequency

and percentages for things like marital status. The diagnostic accuracy of ultrasound/MRI was compared to histology, and the sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were all assessed using a 2X2 model. Stratification helped regulate effect moderators such age, marital status, parity, and complaint length. Statistical significance was set at a p value of 0.05 for the post-stratification diagnostic accuracy calculation.

RESULTS

In this study age range was 18 to 50 years with mean age of 31.613±5.70 years, mean parity 3.130±1.37 and mean duration of complaints was 7.186±2.10 weeks. Ultrasound diagnosed 58(26.4%), MRI 59(26.8%) and histopathology diagnosed 59(26.8%) patients with malignant pelvic masses while ultrasound diagnosed 162(73.6%), MRI 161(73.2%) and histopathology diagnosed 161(73.2%) with benign pelvic masses, respectively. Ultrasound has shown sensitivity of 75.5%, specificity 88.8% and diagnostic accuracy by 83.2%, PPV 69% and NPV 88.3% in characterization of pelvic masses. MRI has shown sensitivity of 83%, specificity 93.7% and diagnostic accuracy by 91%, PPV 83% and NPV 93.7% in characterization of pelvic masses as shown in Table-VI and VII respectively.

Stratification with respect to age, marital status, parity and duration of complaint of Ultrasound/ MRI versus histopathology are shown in Table below.

Characterization of Pelvic Masses	Ultrasound	MRI	Histopathology
Malignant	58(26.4%)	59(26.8%)	59(26.8%)
Benign	162(73.6%)	161(73.2%)	161(73.2%)
Total	220 (100%)	220 (100%)	220 (100%)

Table-I. Overall results of Ultrasound, MRI and Histopathology in characterization of pelvic masses (n=220)

Ultrasound	Histopathology		Total
	Malignant	Benign	
Malignant	40 (TP)	18 (FP)	58
Benign	19 (FN)	143 (TN)	162
Total	59	161	220

Table-II. Comparison of ultrasound versus histopathology for characterization of pelvic masses (n=220)

Chi square= 109.42; P value = 0.000
TP= True positive, **FP** = False positive,
FN = False negative, **TN** = True negative

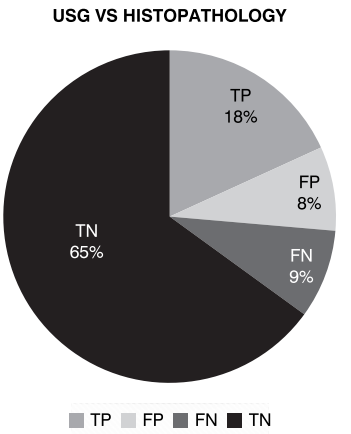

Figure-1

MRI	Histopathology		Total
	Malignant	Benign	
Malignant	49 (TP)	10 (FP)	59
Benign	10 (FN)	151 (TN)	161
Total	59	161	220

Table-III. Comparison of MRI versus Histopathology for characterization of pelvic masses (n=220) Chi square = 129.9; P value = 0.000

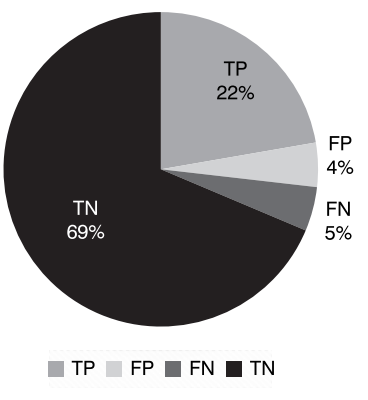

Figure-2

Diagnostic Marker	
Sensitivity	83%
Specificity	93.70%
Diagnostic Accuracy	91%
Positive Predictive Value (PPV)	83%
Negative Predictive Value (NPV)	93.70%

Table-IV. Sensitivity, Specificity, Diagnostic Accuracy, PPV and NPV of MRI for characterization of pelvic masses

Ultrasound	Histopathology		Total	P-Value
	Malignant	Benign		
Malignant	43 (TP)	4 (FP)	47	0.000
Benign	15 (FN)	44 (TN)	59	
Total	58	48	106	

Table-V. Stratification with respect to age (18-30 years) of Ultrasound versus Histopathology (n=98)

Sensitivity: 74.1%; **Specificity:** 91.6%; **DA**=82.1%
PPV= 91.5%; **NPV**= 74.6%

DISCUSSION

All of the participants in this study were of childbearing age. The vast majority of masses were harmless. In both young and old people, a pelvic mass is extremely unusual. Ovarian cancer is more common in women over the age of 45, according to a study conducted by Malik MS, et al.[10] When we looked at the parity of the women in our study, we found that the vast majority of them were parous. Ovarian cancer and uterine fibroids are both conditions linked to being a nulliparous woman. This research confirmed that nullipara women have a higher risk of developing ovarian cancer. Yet, nullipara and grand multiparous women both had a similar risk of developing leiomyoma. Most primary ovarian tumors were detected in women aged 40-60 years old; the oldest patient was 65 years old, and the youngest patient was 15 years old, according to a study by Alam I, et al. Ovarian stress from repeated ovulation is more common in women who have their first child at a younger age or who delay entering menopause.[11]

Qureshi IA et al. evaluated transvaginal and transabdominal ultrasound on 100 patients and found that the former was preferred in 63% of cases, was on par in 27% of cases, and was deemed inferior in 10% of cases. When dealing with big pelvic tumors, transvaginal ultrasound was rated lower than transabdominal, however it was deemed superior when dealing with ovarian follicle monitoring, PCOS, endometrial cancer, or a probable ectopic pregnancy.[12] According to a study conducted by Marret H. et al. using the most recent color Doppler technology, 89% of malignant masses and 70% of benign tumors were discovered.[13] Comparing the types of pelvic masses found, all but four were found to be of a gynecological origin. A total of 68 (30.9%) individuals were diagnosed with a malignant breast lesion using ultrasonography, 59 (26.6%) with magnetic resonance imaging, and 59 (26.6%) via histology. In describing pelvic masses, our research found that ultrasonography had a sensitivity of 75.5%, specificity of 88.8%, diagnostic accuracy of 83.2%, PPV of 69%, and NPV of 88.3%. Diagnostic accuracy of 91%, PPV 83%, and NPV 93.75% have all been demonstrated by MRI.

In a study by Usmani Y, et al. has shown that MRI has sensitivity of 75% and specificity of 93.9% while ultrasound has sensitivity of 75% and specificity of 93.7% in characterization of adnexal masses [7]. In a study by Sultana N, et al. has shown that prevalence of benign lesions was 60.6 % while 39.3 % were malignant lesions.[8] In another study by Mohamed DM, et al. has shown that ultrasound has sensitivity of 67.25% and specificity of 75% in characterization of adnexal masses.[9]

Killackey found that 14.4% of his 291 female patients had uterine leiomyomata and that 33.7% had benign ovarian or tubal cysts.[14] Similar results were found in a study conducted by Bhattacharyya NK, et al, where out of 162 total lesions, 102 were non-neoplastic, such as appendicular lumps, tubo-ovarian masses, or hematomas, and 60 were cancerous.[15]

In addition to analyzing the echo structure and 'elasticity' of a pelvic mass, transvaginal ultrasonography allows for the assessment of localized discomfort in various pelvic regions and the monitoring of the mass's motion in relation to surrounding structures.[16] Nonetheless, it can be

difficult for doctors to tell the difference between a benign and malignant growth.

In order to avoid unneeded operations, our research indicates that MRI is the preferred method of investigation for pelvic tumors. Our findings are in agreement with those found by Adusumilli S. et al.[17] They observed that MRI pelvis has a sensitivity of 100% and a specificity of 94% in diagnosing cancer when used for further assessment of a pelvic tumor initially detected by ultrasonography in a prospective series.

Similarities exist between our study's findings and those of Kinkel et al.[18] who discovered that while MRI is useful for finding cancer, its specificity is what really sets it apart for characterizing pelvic tumors.

CONCLUSION

Since MRI can detect invasion of adjacent organs and organs of origin of lesions with greater specificity and sensitivity, it may be considered complementary for optimal patient management.

When a referring doctor and radiologist work together quickly, they can resolve cases with pelvic tumors. Due to the urgency with which a diagnosis must be made, it is crucial that the right tests be selected from among those that are readily available in order to cut down on both the time and effort required to reach a conclusion. When it comes to diagnosing medical conditions before treatment, ultrasound is still the gold standard. The reduction in morbidity and death from pelvic masses is directly attributable to advances in their detection and characterization, which allow for more precise diagnoses and less unnecessary intrusive operations.

When sonographic characteristics are inconclusive in detecting the origin of the mass or the likelihood of malignancy, MRI should be investigated for examination of the pathology of a pelvic tumor. A definitive diagnosis can only be made through histopathological analysis of a specimen acquired through laparotomy or laparoscopy of a pelvic tumor. There is no one diagnostic tool that can reliably identify problematic pelvic masses on its own. As a result, a comprehensive diagnostic strategy is required for pelvic mass identification and treatment.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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2	Muhammad Nafees	Discussion writing & Review of paper.	
3	Salar Sohail	Data analysis / Entry.	
4	Uzair Sohail	Data entry / Review.	
5	Nidda Ayub	Data collection / Analysis.	
6	Muniba Abid	Manuscript writing.	
7	Muhammad Ahsan	Manuscript writing, Data collection.	