Original Research Article

EVALUATING DIAGNOSTIC VALUE OF MAGNETIC RESONANCE SPECTROSCOPY (MRS) FOR DIAGNOSIS OF MALIGNANT BREAST MASSES

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Abstract: *To evaluate diagnostic value of magnetic resonance spectroscopy (MRS) for diagnosis of malignant breast masses. The study included 155 patients with breast lesions at Department of Radiology, The Children's Hospital and The Institute of Child Health, Multan from January 2021 to June 2021.1.5 Tesla MR system was used for proton magnetic resonance spectroscopy (1H MRS). Consultant radiologist interpreted MR spectroscopy for distinguishing between benign and malignant lesions using histopathology as a gold standard. SPSS 20.0 was used for data analysis. Among 81 MRS positive cases, 76 had malignant lesions (True Positive) and 05 had no malignant lesion (False Positive) on histopathology. Among 74 MRS negative cases, 7 had malignancy on histopathology (False Negative), while 67 had no malignant lesion (True Negative) on histopathology. It was concluded that MRS has high sensitivity and accuracy for diagnosis of malignant breast lesions.*

Keywords: Malignancy, Breast Cancer, Magnetic Resonance Spectroscopy

Introduction

Lumpiness in the breast is common patient complain, with about 40%-70% women seeking consultation. Breast lump give rise to the fear of breast cancer among women (Barakzai et al., 2021). Though, breast lesions are benign majorly, yet palpable breast lesions must be evaluated (Machado, 2018). The aim of this evaluation is to detect malignancy, if any. Evaluation includes extensive history, clinical examination of breast, tissue diagnosis and imaging modalities. Breast cancer is most common form of malignancy globally and leading cause of death after lung cancer. It's common presentation is nipple discharge or lumps (Siegel et al., 2018). Noninvasive interventions for diagnosing breast cancer are a major clinical challenge. Imaging studies significantly define stages of malignancy and help in identification of non-palpable masses in breast region. Findings of the imaging technique influence therapeutic approach and choice if therapy (Pediconi and Galati, 2020). Currently, sonography and mammography are widely used for detection of breast cancer (Runjjala and Naidu). However, limitations of these modalities and desire to detect lesions in early-stage results in aggressive biopsy. Biopsy rate for detection of cancerous lesions is 10% to 30%, which means biopsies are majorly performed for benign lesions causing unnecessary anxiety and discomfort and also increases costs (Ahmadani et al., 2020). Magnetic resonance imaging (MRI) reduces radiation exposure, is more sensitive than mammography and accurately determines the size of lesion (Rasheed et al., 2022). Diagnosis of breast lesion can be improved by using Proton magnetic resonance spectroscopy (1H MRS) along with magnetic resonance imaging (MRI) (Sharma and Jagannathan, 2019). A study reported that specificity and sensitivity of magnetic resonance spectroscopy (MRS) in distinguishing benign and malignant breast lesions was 92.2% and 89.6% respectively (Bukhari et al., 2019). There is scarce data on this topic therefore, the aim of this study is to evaluate diagnostic value of magnetic resonance spectroscopy (MRS) for diagnosis of malignant breast masses.

Methodology

The prospective study was conducted at Department of Radiology, CH & ICH Multan from January 2021 to June 2021. The study included 155 patients with breast lesions detected on ultrasound (non-compressibility, duct extension, punctate calcification and deeper than taller) and mammography (indistinct margins, low fat density and irregular shape), were aged between 30 to 50 years and duration of lesions was greater than 3 months. Patients who were having chemotherapy or irradiation for breast cancer, had previous trauma to breast tissue, proven histopathology, pregnant females, those having chronic illness (diabetes mellitus, chronic renal

failure, or tuberculosis) and contraindication to MRS (cardiac pacemaker holder, MRS incompatible devices). Written consent was taken from the participants and the study was approved by the Ethical Board of the hospital. Relevant history was recorded. 1.5 Tesla MR system was used for proton magnetic resonance spectroscopy (1H MRS).The point-resolved spectroscopy single-voxel technique was used for obtaining fast scout scan. Consultant radiologist interpreted MR spectroscopy for distinguishing between benign and malignant lesions using histopathology as a gold standard. SPSS 20.0 was used for data analysis. For quantitative variables such as BMI, lump size, duration of disease and age standard deviation and mean were calculated. For qualitative variables such as benign and malignant lesions percentage and frequency were calculated. Diagnostic accuracy of MRS, negative predictive value, positive predictive value, specificity and sensitivity were calculated using 2×2 contingency table.

Results

The study was conducted on 155 patients 40.27 ± 4.48 years. Duration of disease was 1.22 ± 0.84 months. Mean lump size was 4.72 ± 2.45 cm. BMI was 30.74 ± 6.35 kg/m2. MRS was performed in all patients. MRS detected malignant breast lesions were found in 81 (52.2%) patients. In 84 (54.1%) patients, malignancy was confirmed by histopathology. Among 81 MRS positive cases, 76 had malignant lesions (True Positive) and 05 had no malignant lesion (False Positive) on histopathology. Among 74 MRS negative cases, 7 had malignancy on histopathology (False Negative), while 67 had no malignant lesion (True Negative) on histopathology (Table I). Diagnostic accuracy of MRS, negative predictive value (NPV), positive predictive value (PPV), specificity and sensitivity are summarized in table II.

Table I Findings of MRS

Histopathology	Positive MRS	Negative MRS	P value
Positive	76	07	0.736
Negative	05	67	

Table II Diagnostic Accuracy of MRS

Parameter	Percentage
Sensitivity	89.17%
Specificity	93.0%
PPV	93.5%
NPV	87.47%
Diagnostic Accuracy	90.61%

Discussion

In the current study, malignant breast lesions were detected in 81 (52.2%) using MRS. Sensitivity and specificity was 89.17% and 93.0%. In another study, sensitivity and specificity of MRS for distinguishing benign and malignant lesions was found to be 89.6% and 91.2% respectively (Thakur and Bitencourt, 2022). A study investigated use of MRS along with MRI for diagnosis of breast lesions (Sharma and Jagannathan, 2022). In this study, women with suspicious breast mass of 1 cm diameter were examined. Biopsy was used as a gold standard, blinded review reported sensitivity and specificity of MRI to be 96% and 85% respectively. Blinded review of MRS showed sensitivity and specificity to be 84% and 86% respectively. It was found that positive predictive value and specificity of MRS could be improved to 95% and 92% if tubular adenomas detected on MRS (reason of false positive results) were excluded by MRI. A meta-analysis of five studies investigating diagnostic value of MRS for differentiating between malignant and benign lesions were examined (Lima et al., 2019). Estimated sensitivity and specificity of MRS for distinguishing between malignant and benign breast lesions was found to be 83% (94% CI 72%–88%) and 85% (94% CI 70%–92%). Another study reported sensitivity and specificity of MRS to be 73% and 77% respectively (Sharma et al., 2019). Another retrospective study was conducted to investigate diagnostic value of MRI and MRS in patients who underwent biopsy previously (Galati et al., 2019). In this study radiologists estimated the probability of malignant breast lesions on the basis of MRI results. They made hypothetical recommendations about confirmatory biopsy. Radiologists reexamined their recommendations after MRS results were diagnosed. It was found out that MRS results in higher accuracy, sensitivity and specificity regarding detection of malignant breast lesions. A study conducted by Wu L-A et al. reported sensitivity and specificity of MRS in detecting breast malignancy to be 91% and 93% respectively (Wu et al., 2021). In a meta-analysis, data from 19 studies was pooled (Gu et al., 2022). The overall specificity and sensitivity were found to 88% and 73%. The overall diagnostic odd ratio was 35.3. A study investigated diagnostic value of MRI and MRS in 50 subjects with 56 distinct lesions (Mohamed et al., 2018). Of 56 lesions, MRI classified 41 as suspicious and referred for biopsy. The remaining were already detected as being malignant by biopsy. Biopsy was used as gold standard, of 56 lesions 29 and 27 were reported to be malignant and non-malignant respectively. In all 29-biopsy detected malignant lesions choline peak was present (100% sensitivity), in 24 of 27 benign lesions peak was absent (88% specificity). For evaluating the

effect of using MRS as an adjunct to biopsy MRI detected 41 suspicious lesions were investigated. It was observed that positive predictive value of biopsy could be improved from 36% to 81% by using MRS along with MRI.

Conclusion

It was concluded that MRS has high sensitivity and accuracy for diagnosis of malignant breast lesions. It has also improved patient care by timely and accurate diagnosis. As it is noninvasive and sensitive, that is why it is recommended as a screening tool for preoperative diagnosis of malignant breast lesions. It reduces diagnostic biopsies and resulting complications.

Authors Contribution

Zia, Mahwish, Zeeshan, conceived designed and did statistical analysis & editing of manuscript, Umar, Faisal, Atqa, Mahwish, did data collection and manuscript writing Zia, Atqa, did review and final approval of manuscript.

Conflict of interest

The authors declared absence of conflict of interest.

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