Proceedings of Anticancer Research

Research Article

Evaluation of Diagnostic Value of Ultrasound and Magnetic Resonance Imaging for Malignant and Benign Breast Lesions

Yanni Zeng, Hongwei Zhang, Jiuxia Zhang, Yan Yu, Liangjin Liu*

Hubei Third People's Hospital Affiliated to Jianghan University (Hubei Zhongshan Hospital Affiliated to Jianghan University), Wuhan, Hubei, 430033, China

Abstract: Objectives: To investigate diagnostic value of ultrasound and magnetic resonance imaging (MRI) for malignant and benign breast lesions. Methods: Retrospective analysis of treatment data of 48 patients diagnosed with malignant and benign breast lesions in our hospital, collected from December 2017 to November 2018. A total number of 56 breast masses were examined by both ultrasound and MRI, and were compared with postoperative pathological biopsy results. Results: Postoperative pathological biopsy results showed that there were 26 and 30 malignant and benign lesions respectively. Comparison of MRI curve type of malignant and benign lesions showed statistical significance ($P<0.05$). By comparison with pathological biopsy results, specificity and sensitivity of ultrasound diagnosis were 83.33% (25/30) and 84.61% (22/26) respectively; specificity and sensitivity of MRI diagnosis were 96.66% (29/30) and 92.30% (24/26) respectively. Conclusions: Ultrasonographic examination of malignant and benign breast lesions is straight-forward, simple and inexpensive. Accuracy, specificity and sensitivity of MRI are significantly higher than ultrasound in examining malignant and benign breast lesions, this can reduce misdiagnosis.

Keywords: *breast; malignant lesions; benign lesions; ultrasound; MRI*

Publication date: September, 2018

Publication online: 30th September, 2018

Corresponding Author: Liangjin Liu, llj.98f@163.com

0 Introduction

Breast disease is a common clinical disease which mainly affects females; it causes serious health impact and reduces life quality of patient. Early detection, early diagnosis and early treatment should be taken to improve treatment effect in patient and to promote improvement of patient's prognosis. When using ultrasound to examine patient's condition, judgement of breast mass characteristics is mainly based on blood flow distribution in the breast mass[1]. When using MRI to examine patient's condition, characteristics and malignancy of breast mass are mainly determined based on neovascularization around breast mass and blood perfusion[2]. Research topic of this group was to study the diagnostic values of ultrasound and MRI for malignant and benign breast lesions; 48 patients were recruited and report is as follows.

1 Materials and methods

1.1 Materials

This retrospective analysis randomly selected 48 patients with malignant and benign breast lesions clinically diagnosed from December 2017 to November 2018 in our hospital; a total of 56 breast masses were collected. Patients aged 31 to 59 with median age of 35.8, informed consent was obtained, had no obvious symptoms. Patients unwilling to cooperate; with serious blood system diseases; with severe heart, liver and kidney dysfunctions were excluded from this study. Ethical approval was obtained from ethics committee of hospital.

1.2 Methods

Ultrasound and MRI were performed in all 48 patients.

During ultrasound examination, each patient was in supine position; upper limbs were lifted to fully expose both breasts and armpits; high-frequency probe was used to radially explore mammary surface of patient during routine examination of both breasts and armpits. During MRI examination, each patient was in prone position; dedicated double breast surface coil was used to allow natural hanging of both breasts[3]. Scans were performed to patient's both breasts using MRI instrument, included sagittal scan and conventional transverse scan; coronal scan was performed on patient if necessary.

1.3 Effect analysis[4]

MRI scan images of breast lesions were processed and analyzed with reference to breast imaging-reporting and data system related standards. Time-signal intensity curve (TIC) was divided into I, II and III types. Type I showed curve with rapid rise in initial stage and rise by >10% in delayed period. Type II showed curve with rapid rise in initial stage and constant after reaching the peak. Type III showed curve with rapid rise in initial stage but >10% wash-out in delayed stage.

1.4 Statistical method

Data analysis by SPSS19.0 software; quantitative data by t test (mean±standard deviation); categorized data by X^2 test (rate); difference with $P<0.05$ was considered statistically significant.

2 Results

Postoperative pathological biopsy results showed that there were 26 and 30 benign lesions and benign lesions respectively; while number of patients was 23 and 25 respectively. Comparison of MRI curve type between malignant and benign lesions showed statistical significance ($P<0.05$). By comparison with pathological biopsy results, specificity and sensitivity of ultrasound diagnosis were 83.33% (25/30) and 84.61% (22/26) respectively; specificity and sensitivity of MRI diagnosis were 96.66% (29/30) and 92.30% (24/26) respectively.

Table 1 Comparison of MRI curve type between 2 groups of patients (%)

Group	Number	Type Ⅰ	Type Ⅱ	Type Ⅲ
Benign	30	24（80.00）	3（10.00）	3（10.00）
Malignant	26	2（7.69）	9（34.61）	15（57.69）
X_2		29.2791	5.0126	14.5252
P		＜0.05	＜0.05	＜0.05

Table 2 Comparison result between ultrasound diagnosis and pathological biopsy

Pathological biopsy	Ultrasound diagnosis		Total
	Malignant	Benign	
Malignant	22	4	26
Benign	5	25	30
Total	27	29	56

Table 3 Comparison result between MRI diagnosis and pathological biopsy

Pathological biopsy	MRI diagnosis		Total
	Malignant	Benign	
Malignant	24	2	26
Benign	1	29	30
Total	25	31	56

3 Discussions

Clinical incidence of breast cancer is high. If malignant mass is smaller when disease is detected, prompt treatment can improve quality of life and prognosis. Clinical diagnosis of breast disease mainly uses high-frequency ultrasound and MRI technologies; they have a wide range of clinical applications and can be used to screen breast cancer patient effectively[5].

High-frequency ultrasound has prominent clinical advantages: no radiation, simple operation, low cost and can be performed repeatedly. It is the first choice for clinical diagnosis of breast disease. Ultrasonography

can clearly show specific conditions of breast mass in breast disease patient, such as size, location, shape, number and boundary; it can clearly illustrate blood flow and echo condition inside mass[6]. In particular, its diagnostic effect is accurate in intraductal breast lesion. In addition, ultrasonography can be used to examine for occurrence of axillary lymph node metastasis in breast disease patients, to position lesion in surgical patients, and to identify physical properties of tumor; it has higher accuracy and clinical promotion value. However, effect of ultrasound diagnosis examination is not ideal in masses with no obvious echo change or in patients with early stage breast cancer—no typical morphological feature and no rich blood supply; because breast lesions are rich in fats, resolution can be reduced if fibrous gland tissues overlap or disorders cause intraductal lesions; tiny benign mass can not be effectively identified, resulting in higher rate of missed diagnosis.

Ultrasonography analysis of breast cancer lesions demonstrated that some patients with masses of irregular and unclear border manifest crab-leg-like changes. Investigation of cause showed that it is related to invasion and infiltration of breast cancer mass into surrounding normal tissue; most patients present low internal echoes, uneven lesions, tiny calcification in some lesions, attenuating posterior echoes and irregular liquid dark areas can be seen in a few lesions. For patients of early stage, images of cancer tumor are not typical, thus they are more difficult to be distinguished from benign lesions. Clinical analysis revealed that a small number of breast cancer patients show reduced blood, while blood flow can be richer in benign mass; this can promote formation of borderline mass. Therefore, it is more difficult to perform ultrasound examination in patients with tumor of diameter <1cm, who do not have rich blood flow; hemodynamic indicator can not provide comprehensive data to allow accurate clinical diagnosis of patient’s condition; no typical morphological features and thus high rate of missed diagnosis.

MRI examination is widely used in clinical practice. Its application can provide extensive and comprehensive information in screening breast cancer patient; it is non-invasive and can distinguish soft tissue of patient body with very high degree[7]; compared with ultrasound examination, its clinical promotion value is significantly higher. When MRI is used for routine scanning of mammary gland, distribution of internal signals within tumor tissue is uneven if the tumor shows deep lobular features, burr-like features or irregular shapes; patient skin is locally thickened and this can confirm diagnosis of breast cancer. However, during MRI scan, if tumor is smaller, tumor shape is slightly irregular or tumor is hidden, such breast cancer lesions are easily missed diagnosis. Therefore, MRI scan and ultrasonography do not have significant difference in identifying such benign and malignant breast lesions. However, enhanced MRI scan clearly illustrates internal structure and shape of patient's breast mass, and can determine relationship between lesion and surrounding tissue. In case of malignant mass, infiltration degree of lesion can be clarified and invasion degree of tumor to chest muscle can be determined. According to analysis, blood vessels in benign tumor are relatively lesser compared with malignant mass; when enhanced scan is performed, contrast agent distributes in extravascular-extracellular matrix. Malignant tumor is richer in blood vessels; following injection of contrast agent, enhancement is obviously more rapid than in benign mass. Therefore, in identification of benign or malignant mass by examining ring-enhancement or uneven-enhancement, proportion of ring-enhancement is about 67.0%.

Resolution is higher when MRI is used to examine soft tissue; thus its sensitivity and accuracy for patients with partial breast lesions are significantly higher compared with ultrasonography. It can be used as an auxiliary examination method for preoperative evaluation, clinical staging and surgical mode selection of breast cancer[8]; it is effective and feasible. However, clinical analysis confirmed that MRI is not sensitive in diagnosing calcifying lesions; its operation process is complicated, time-consuming and high cost. In benign and malignant lesions, there are certain overlapping of enhancement curves; thus larger difference in diagnosis specificity.

According to analysis, breast cancer patients may have MRI enhancement due to surgical factor, scar tissue, radiotherapy, inflammatory reaction, radiotherapy and other factors. Therefore, it is recommended that patients undergo radiotherapy at least 1 month after surgery, and MRI examination 9 months after radiotherapy.

Investigation on principle behind misdiagnosis of benign lesion showed that it is mainly due to obvious enhancement of lesion; it is certainly related to diagnosis level. Detection of intraductal papilloma using MRI easily leads to missed diagnosis and misdiagnosis. According to analysis, MRI examination is not

influenced by radiotherapy, chemotherapy, surgery and other factors. It can provide clear illustration of tumor cell invasion to chest wall and lymph node metastasis. It can effectively determine preoperative stage and monitor recurrence of patient.

Ultrasound and MRI have their own advantages and disadvantages for examining malignant and benign breast lesions. In clinical application, both diagnostic methods can provide reliable data for clinical treatment of breast cancer patients when selected appropriately. They are helpful in grasping patient condition changes timely, predicting of patient's efficacy, and monitoring of disease recurrence in patient.

Results of this study: specificity and sensitivity of ultrasound diagnosis were 83.33% and 84.61% respectively; specificity and sensitivity of MRI diagnosis were 96.66% and 92.30% respectively. Results confirmed that the use of MRI in malignant and benign breast lesions is more feasible.

In summary, clinical advantages of using ultrasound examination for malignant and benign breast lesions are straight-forward, simple and inexpensive. Accuracy, specificity and sensitivity of using MRI for malignant and benign lesions are significantly higher, and rate of misdiagnosis is lower; it should be recommended for clinical practice. In post-clinical conference, in-depth analysis of malignant and benign breast lesions diagnoses, increase of samples selected, and prolonged sampling time promote greater clinical representativeness and guidance significance of the clinical trial results by this group.

References

[1] Ping Li, Yun Zhou, Yan Huang. Comparison of diagnostic value of X-ray ultrasound and MRI for benign and malignant breast lesions [J]. Hebei Medicine,2016(11).

[2] Ping Lu. Diagnostic value of ultrasound and magnetic resonance imaging for benign and malignant breast lesions [J]. Journal of Hubei University for Nationalities(Medical Edition), 2017(4).

[3] He Xiaoqing, Liang Hanhuan, Feng Qingyi, et al. Clinical application of ultrasonography and magnetic resonance imaging in the diagnosis with benign and malignant breast lesions[J]. Journal of Guangdong Medical College, 2016(5).

[4] Wei Wei. Comparative study of magnetic resonance imaging and ultrasound in diagnosis of breast malignant lesions [J]. Chinese Journal of Critical Care Medicine (Electronic Edition), 2016, 9(2): 122–124.

[5] Yang Zhang. Diagnostic efficacy of three most commonly used imaging methods of ultrasound, mammography and enhanced magnetic resonance imaging for breast lesions [J]. Guide of Chinese Medicine, 2017(30): 94.

[6] Baotao Zhang. Diagnostic value of color ultrasound, X-ray mammography and magnetic resonance imaging for breast cancer [J]. China Continuing Medical Education, 2018.

[7] Chunping Wei, Shuying Bai. Comparison of diagnostic value of high frequency ultrasound, magnetic resonance and their combination for breast cancer [J]. Chinese Journal of Control of Endemic Diseases, 2016, 31(5): 582.

[8] Hao Yang, Wenwei Chen, Jiabao Yin. Clinical value of ultrasound elastography combined with magnetic resonance imaging in the diagnosis of breast cancer [J]. China Medical Herald, 2016, 13(25).