

Clinical Study of MRI Diagnosing Technique of Breast Lesions

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Abstract Objective To evaluate the application value in diagnosing breast lesions by MRI. **Methods** 63 female patients with suspected breast lesion underwent X-ray mammography, ultrasound, plain MRI and contrast-enhanced MRI examination, and then all of them received surgery treatment and pathologic examination. Results MRI applied to 63 cases found 2 affected with other than breast disease and the two traditional methods failed to give correct diagnosis for the 2 cases. The sensitivity, specificity and overall accuracy of Contrast-enhanced MRI 91.4%, 96.2%, 92.0% respectively in terms of benign and malign lectiferous glands tumor, and Plain MRI presented the accuracy of 79.3% in terms of breast disease. the accuracy of X-ray mammography and ultrasound are 66.7%, 67.8% respectively. **Conclusion** As far as diagnosing breast lesions is concerned, contrast-enhanced MRI is superior to other methods and plain MRI presents no significant difference with X-ray and ultrasound.

Key Words: Breast lesion; Diagnose; Magnetic resonance imaging; Contrast-enhanced MRI

Breast cancer, a common disease in women, has risen to first in terms of incidence among the women malignant tumors in many countries. The diagnosing techniques of breast tumors in the past 20 years has seen rapid developments. Now there are many diagnosing methods available but none of them has high sensitivity and specificity or is an ideal provider of iconographical information for conservative operation treatment. Because of its mutli-parameters imaging, freedom of ionizing radiation, and high quality parenchyma image, the newly developed Magnetic Resonance Image (MRI) can provide affluent iconographical information.

MATERIALS AND METHODS

Patients' data

Between October 2000 and October 2002, 63 female patients with suspected breast lesion, aged 21-67 years old (mean age 48.3 years old) underwent X-ray mammography, ultrasound, plain MRI and contrast-enhanced MRI examination and then all of them received surgery treatment and pathologic examination.

Installations

Signa Horizon Echospeed 1.5-T Superconductor Imager with double breast phased array surface coil (GE Medical Systems, USA). DGX-3 Radiographic

Apparatus (Shanghai Xin Yue Instrument Manufactory, China). Medical 2002 Ultrasonic Diagnosis Apparatus (B&K Co Ltd., USA). Breast Infrared Diaphany Scanner (Da Heng Co Ltd., China).

MRI Protocol

The patients were scanned while lying prone with breast suspended in the double breast phased-array surface coil. The axial and sagittal T₁WI (TR 500~700msec, TE 10~15msec), T₂WI (TR 3200~4000msec, TE 80~100msec) were obtained using 2D spin echo sequence with fat suppression (section thickness, 4mm; section gap, 1mm; Sagittal field of view, 16~20cm, Axial field of view 30~40cm; matrix, 2565 (192~224); excitation, 1~3; acquisition time, 1~3min). Subsequently, 0.2mmol/kg Gd-DTPA was intravenous bolus injected through the venae intermedia cubiti and the same section of contrast-enhanced T₁WI was acquired after injection 1, 3, 5, 7 min with the same technique.

RESULTS

In 63 patients, histopathological examination found 34 breast cancer cases with a single focus, and 27 cases with 53 foci of benign lesions, in which 14 case with 35 foci fibroadenoma, 11 with 16 foci of dysplasia, 2 with galactocoele. 2 cases were excluded from breast disease (one is left ec-

topectoralis abscess and the other is right axillary spongy aneurysm-lymphangioma).

Contrast-enhanced MRI applied to 63 cases, found 61 cases with 87 breast lesions and 2 cases affected with other than breast disease. The sensitivity, specificity, overall accuracy 91.4%, 96.2%, 92.0% respectively in terms of benign and malign lectiferous glands tumor. Plain MRI located the non-breast disease in the 2 cases, and its diagnosing accuracy 79.3% in terms of breast disease. The two traditional methods failed to give correct diagnosis for the 2 cases. X-ray mammography and ultrasound had the accuracy of 66.7% and 67.8% respectively. Compared with plain MRI, X-ray mammography and ultrasound had no significant difference in accuracy of diagnosing breast disease, but they had a relatively high false negative. (Table 1)

DISCUSSION

The Traditional Iconography Examinations

X-ray mammography is a common method used in breast iconographical examination. Because it can clearly reveal microcalcifications and small irregular densities in fatty breast, X-ray provides a high sensitivity in diagnosing breast cancer. But the sensitivity decreases in case of dense breast (22% breast cancer cases occur in women under 50 years old and most of them are with dense breast^[1]). Both the sensitivity and specificity of X-ray may be still less satisfactory owing to the defects in the X-ray mammography technique (for example tissue image

overlapping and low tissue contrast), radiologist's lack of experience and technique imperfection. As the radioactive ray is a cancerogenic factor, it is controversial whether X-ray mammography should be determined as a routine examination for women under 35 years old.

Ultrasound is painless, causing no injury, nor affected by dense breast. Moreover, it is fit for adolescent, suckling and pregnant women. Its precious value lies in its ability to distinguish between solid mass and cyst. Breast ultrasound can detect more than 90% cyst lesion, which is important to find microcyst^[2]. But lots of studies indicate that ultrasound has a high false negative and false positive. This is accountable by the following facts. (1) some benign lesions lack the images of the typical benign tumor. For instance, the large fibroadenoma trends to inflate so as to show the imperfect capsule, irregular border and shape^[3]. In our study, three of the six benign lesions are misdiagnosed as big fibroadenomas by ultrasound. (2) It is difficult to diagnose the small malignancies because of its relatively regular shape and well-circumscribed border, especially accompanied with dysplasia. In 6 malignant lesion cases misdiagnosed as fibroadenomas by ultrasound, four are less than 2cm in diameter and 2 complicated by proliferative dysplasia. (3) Ultrasound can not detect occult carcinomas or less than 5mm lesions. (4) Ultrasound can not definitely reveal microcalcifications.

The above-mentioned methods have been the main ones used in diagnosing breast disease be-

Table 1 the results of diagnosing breast lesions by different methods

	Malignant (34 lesions)			Benign (53 lesions)			Total (87 lesions)		
	TP(%)	FP(%)	FN(%)	TP(%)	FP(%)	FN(%)	TP(%)	FP(%)	FN(%)
Enhanced MRI	32* (94.1)	2 (5.9)	0	50 (94.3)	3 (5.7)	0	82 (94.3)	5 (5.7)	0
pLAIN MRI	30** ^H (88.2)	4 (11.8)	0	39 ^H (73.6)	8 (15.1)	6 (11.3)	69 ^H (79.3)	12 (13.8)	6 (6.9)
X-ray	28 ^H (82.4)	5 (14.7)	1 (2.9)	30 ^H (56.6)	5 (9.4)	18 (34.0)	58 ^H (66.7)	10 (11.5)	19 (21.8)
Ultrasound	26 ^H (76.5)	6 (17.6)	2 (5.9)	33 ^H (62.3)	6 (11.3)	14 (26.4)	59 ^H (67.8)	12 (13.8)	16 (18.4)

TP: True Positive FP: False Positive FN: False Negative

* There is significant difference between contrast-enhanced MRI and plain MRI, X-ray, ultrasound in diagnosis accuracy. ($X^2 > 4.22$, $P < 0.05$).

H: In diagnosing breast lesions, plain MRI presents no significant difference with X-ray and ultrasound ($X^2 < 3.53$, $P > 0.05$).

cause of their cheap, simple and convenient to exam, but all of them have the same deficiencies: for instance, they can not detect the upper or deep lesions and the auxiliary nodes. As for Chinese's women, whose breasts are relatively small, not all of them are suitable to accept the above examinations. MRI is sometimes a best choice because breast is a soft tissue containable by the RF coil and because the histological and biochemical features of lactiferous glands tumor makes it distinguishable from normal lactiferous glands.

The Clinical Value of MRI in Diagnosing Breast Lesions

Compared with conventional methods, an obvious advantage of MRI is its ability to scan the breast section by section and MRI is acquiring high space and time resolution with the development of technique. Compared with other iconographical examinations, plain MRI accurately shows the size, border and invading of the breast lesions, especially in the case with multicenters or multifocus.

It was hoped that plain MRI could increase the sensitivity and specificity of diagnosing breast tumors by a big margin, but it practically had no evident advantage over the conventional methods because there were overlaps of malignant with benign lesions in the plain MRI. The technique factors, the quality of MRI images and the construction of tumors may be responsible for this[4,5]. We found that there was no obvious superiority of plain MRI over X-ray and ultrasound in diagnosing breast lesions.

Contrast-enhanced MRI was adopted in breast examination in the eighties when gadolinium became the contrast agent of MRI. But fatty tissue is easily confused with the tumors, the enhanced lesion in particular because the fatty tissue shows a high signal region both in T₁WI and T₂WI. To solve the issue, the fat suppression technique is now available, which may transform the high signal of fatty tissue to the low signal, thus able to bring out the tumors in terms of their morphological characteristics and blood supply.

It is found that contrast-enhanced MRI differentiates malignancies from benign lesions not only depending on the morphology but also on the characteristics of the enhancement. Moreover it clearly displays the amount, size, location, border, shape,

construction and relationship of lesions, and hence provides ideal iconographical information for the conservative operation. It is also reported that contrast-enhanced MRI has a high sensitivity (94%~100%)^[6-8] in diagnosing breast carcinomas, but the specificity varies from 37% to 98%^[6-8]. The vast variation may be explained mainly by: (1) the characteristics of enhancement in overlapping malignant and benign lesions; (2) different purposes and different criteria for patients' selections in different studies; (3) different qualities of images due to the different scanner and sequence. In our study, contrast-enhanced MRI is superior to other methods in diagnosing breast lesions with a high sensitivity (91.4%), specificity (96.2%) and accuracy (94.3%).

As a new breast iconographical method, contrast-enhanced MRI can not only accurately diagnose breast lesions, but also provide credibly iconographical information for conservative operation treatment. Although MRI examination is as yet expensive, along with the economical development, and the improvement of the women's social status and living standards, breast contrast-enhanced MRI is sure to find its wide use in our country.

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