The value of 18-FDG-PET for diagnosing and evaluating lymph node metastasis in primary breast cancer

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【Abstract】 **Objective**: To analyze the result of 18F-2-deoxy-2-fluoro-D-glucose-positron emission tomography (FDG-PET) in suspicious primary breast cancer patients and to evaluate its value for the surgery therapy. **Methods**: Total 36 patients suspected of breast neoplasm were enrolled into the research. The result was compared with the pathology result. The rate of missed diagnosis, the rate of misdiagnosis, the sensitivity and specificity were calculated and analyzed. **Results**: Compared with the pathology results, the misdiagnosis rate, the rate of missed diagnosis, the sensitivity and specificity of FDG-PET for breast cancer were 0%, 36.36%, 63.63% and 100%, respectively. To those who had a neoplasm no more than 2 cm in diameter, the rate of missed diagnosis was as high as 41.67%. To 33 breast cancer patients, the misdiagnosis rate, the rate of missed diagnosis, the sensitivity and specificity for lymph node metastasis were 18.75%, 41.18%, 58.82% and 81.25%, respectively. **Conclusion**: FDG-PET has a perfect specificity and a considerable sensitivity to the primary breast neoplasm and similar to the lymph node metastasis diagnosis. It is an ideal choice for those patients with suspected breast cancer but reluctantly to receive a vulnerarious examination.

【Key words】 breast cancer; diagnosis; PET

Breast cancer is one of the most common non-dermatologic malignancies in women. The incidence is increasing and now women suffer from breast cancer by a chance of 1 in 8 in the lifetime. Accurate staging of breast cancer has important therapeutic and prognostic implications for optimal patient care[1,2]. Conventional imaging methods, such as mammography, sonography, CT, and MRI, provide detailed anatomic information about the size and location of masses, but no unique metabolic information available without positron emission tomography (PET). The metabolic information generally affords PET several advantages over the anatomic modalities, including earlier detection of malignancy, differentiation of scar or benign lesion from active malignancy, detection of metastatic disease in normal-size lymph nodes, and assessment of early tumor treatment response[3].

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PATIENTS AND METHODS

Patients Between October 2002 and July 2004, 36 consecutive female inpatients or outpatients with known breast tumor were enrolled in this study (patient with benign lesions followed up for 6 months), the mean of age was 47.8 years (range: 36-67 years old). The samples comprised patients who had not got a final diagnosis by conventional imaging methods but could not be excluded of breast cancer clinically and patients who had histological proven breast cancer and wanted to know the metabolic information. Only the initial PET study for each patient was retrospectively reviewed in this study. However, the clinical follow-up information, including imaging results, if available, was acquired to verify the PET findings. Exclusion criteria included pregnancy, diabetes, and neoadjuvant therapy before examination. All patients signed an informed consent

form, and each procedure was approved by our institutional Ethics Committee.

FDG-PET imaging One or 2 weeks before sentinel node biopsy, all patients underwent preoperative FDG-PET examination with a triple-headed hybrid gamma camera with coincidence detection (Irix; Marconi Corp., Cleveland Heights, OH, USA). In order to depress the secretion of insulin, the patients were asked to fast for 12 h (at least 6 h) before the examination. They were encouraged to drink water for more emiction and should urinate before the examination[4]. All patients could drink coffee to increase the fatty acid and decrease the intake of FDG in cardiac muscle. Serum glucose levels were measured to ensure the patient was euglycemia (<7 mmol/L). Transmission scan of Ga-68 was performed for attenuation correction. A bolus of fluorodeoxyglucose (FDG) (300 mBq IV, Hawkeye, GE Company, USA) with a 110 min half life was prepared just before examination and then injected. Fifty minutes after the injection, a whole body scan and abdominal tomoscintigraphy were systematically performed in the supine position, followed by thoracic tomoscintigraphy in the prone position with the arms in extension, by using a mammoscintigraphy table. Each tomoscintigraphic acquisition, which involved an effective field of view of 35 cm, was performed by using 30 steps with a gradient of 6°, lasting 30 s at the start of acquisition (and then longer as FDG decayed). Only photons with energy of 511 ± 102 kV were accepted. Slices were reconstructed by using an iterative algorithm (maximum likehood-expectation maximization) and a 128×128 matrix.

Operation Patients who had histological proven breast cancer underwent breast-conserving therapy or radical adenomammectomy within one week. Pathological results in operation and after operation were made by more than 2 pathologists. UICC TNM Staging was used. Patients who had been clinically diagnosed benign breast disease also underwent clinical surgeries. If the pathology result in operation was benign, the patient would be followed up once a month and last for 6 months. If the pathology result was malignant, the patient should be admitted then and received breast-conserving therapy or radical adenomammectomy.

RESULTS

Diagnosis of primary lesion The evaluation of FDG-PET results was based on calculated sensitivity, specificity, accuracy, and positive and negative predictive values relative to the histopathologic status of the lesion, as follows: Diagnosis of 36 mammary primary lesions was based on the gold standard pathological test (Tab 1). Misdiagnosis rate was 0 (false positive, 0/3), rate of missed diagnosis was 36.36% (false negative, 12/33), sensitivity was 63.63% (true positive, 21/33), specificity was 100% (true negative, 3/3), crude agreement was 91.6%, adjusted agreement was 70.91%, and Youden index was 0.64. There were 11 cases with tumors less than 2 cm in diameter, 6 malignant cases and 5 benign cases were diagnosed by PET, rate of missed diagnosis is 41.67%. While there were 22 cases with tumors more than 2cm in diameter, 15 malignant cases and 7 benign cases were diagnosed by PET, and the rate of missed diagnosis was 31.82%.

Tab 1 Pathological diagnosis results for 36 mammary primary lesions

	Malignant	Benign	Total
PET positive	21	0	21
PET negative	12	3	15
Total	33	3	36

Diagnosis of axillary's lymph node metastasis There was no lymph node metastasis for 3 benign cases. The diagnosis results of axillary's lymph node metastasis for 33 malignant cases are in Tab 2. Misdiagnosis rate was 18.75 % (false positive, 3/16), rate of missed diagnosis was 41.18% (false negative, 7/17), sensitivity was 58.82 % (true positive, 10/17), specificity was 81.25% (true negative, 13/16), crude agreement was 69.70%, adjusted agreement was 75.50%, Youden index was 0.40.

DISCUSSION

2-Deoxy-2-[18F]fluoro-D-glucose(18F-FDG)