Evaluation of some ratio effects in ^{99m}Tc-MIBI imaging of breast tumors

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Abstract The effectiveness of using some ratios in ^{99m}Tc-MIBI imaging for the diagnosis of breast tumors was evaluated. After 100 patients with the breast tumor underwent ^{99m}Tc-MIBI imaging, the ratios of tumor to contralateral uptake (T/N), tumor to heart uptake (T/H), and tumor to sternum uptake (T/S) were obtained and then analysed about their reproducibility and values in differentiating benign breast lesion the from malignant tumor. To detect breast cancers, the sensitivity, specificity and accuracy of T/N were 92%, 90% and 91%, respectively. However, those of T/S were 70% (p <0.01), 74% (p <0.05), 72% (p <0.01), and those of T/H were 74% (p <0.05), 76% (p >0.05), 75% (p <0.01). The average coefficients of variation(CV) of T/N, T/S and T/H were 9.439±9.712, 4.856±4.420 (p >0.05), and 3.736±3.489 (p <0.05). It was found that T/N had the best sensitivity, specificity and accuracy to detect the breast cancer, but its reproducibility is poor. On the other hand, T/H has better reproducibility.

Keywords Mammary neoplasms, Radionuclide imaging, MIBI

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1 INTRODUCTION

Use of the radionuclide imaging is attracting attention for detection in breast cancer.[1~4] It plays an important role to early diagnose, discover axillary lymph node metastasis and evaluate the multidrug-resistant of the breast cancer. At present, most authors use tumor/normal value to express the radionuclide uptake in a tumor.[5~6] In this study, we compared the tumor/normal ratio with some other ratios.

2 MATERIALS AND METHODS

One hundred patients with a histologically confirmed breast tumor were selected into this study, 50 patients with malignant breast tumor (age range, 23–80 years old) and 50 with benign breast lesion (age range, 25–79 years old). All patients were intravenously injected with 740 MBq ^{99m}Tc-MIBI in the arm contralateral to the lesion. Static Planar images (128×128 matrix)were obtained at 30 min after the injection. The

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imaging equipment was Elscint APEX SP-4HR SPECT. Regions of interest were drawn around each lesion in the image, and quantitative analysis of the abnormal uptake of the radiopharmaceuticals was performed. The ratio of tumor to contralateral uptake (T/N), ratio of tumor to heart uptake (T/H), and ratio of tumor to sternum uptake (T/S) were calculated. Their values to detect malignant breast tumors were compared.

Among the 50 patients with the breast cancer, 10 patients received Static Planar images at 30 min and 120 min after the ^{99m}Tc-MIBI injection. 5 numerical values of T/N, T/H and T/S in each time were caculated by two doctors in blindness. The coefficients of variation (CV) of the three ratios were calculated, and the reproducibility of the three ratios was compared.

The values of T/N, T/H, T/S were expressed as mean ±s.d. To test the differences among these parameters and between the benign breast lesion and malignant breast tumor, the Student's t-test was used. χ^2 test was used to assess the differences of sensitivity, specificity and accuracy. Results were considered significant when the p value was below 0.05.

3 RESULTS

For 50 benign breast lesions, the average value of T/N was 0.995± 0.154, T/S was 0.908±0.152, T/H was 0.359±0.065, but for 50 breast cancer, the average value of T/N was 1.499±0.382(p <0.01), T/S was 1.160±0.342(p <0.01), T/H was 0.487±0.173(p <0.01).

The different cut-off points of the three ratios were used to evaluate its effects on the breast cancer diagnoses. To detect a breast cancer, the sensitivity, specificity and accuracy of T/N were 92%, 90% and 91%. However, those of T/S were 70% (p <0.01), 74% (p <0.05), 72% (p <0.01), and those of T/H were 74% (p <0.05), 76% (p >0.05), 75% (p <0.01). (Table 1).

Table 1 Effects of T/N, T/S and T/H to detect breast cancers

	Cut-off point	Sensitivity/%	Specificity/%	Accuracy/%
T/N	1.1	92	90	91
	1.2	86	98	92
	1.3	66	98	82
T/S	0.95	76	62	69
	1.00	70	74	72
	1.15	50	92	71
T/H	0.35	82	48	65
	0.40	74	76	75
	0.45	60	92	76

For 10 patients with breast cancer, the CV of T/N, T/S and T/H were 9.439±9.712, 4.856±4.420 (p >0.05) and 3.736±3.489 (p <0.05), respectively. The CV of T/N was the highest of three ratios, and the CV of T/H was significantly lower than that of T/N. These data revealed that the T/H had a better reproducibility than T/N.

4 DISCUSSION

The ^{99m}Tc-MIBI image was proved useful in the detection of breast cancer. It is frequently reported that the caculated T/N is used for a standard to distinguish a benign lesion from a malignant tumor. We observed the effects of T/N, T/S and T/H in ^{99m}Tc-MIBI imaging of the breast tumor. The three ratios all can differentiate between the benign and malignent breast tumor.

In Table 1, we find that the T/N has the best sensitivity, specificity and accuracy of the three ratios. The data of the T/S or T/H reveal a lot of cross between the benign lesion and malignant tumor. This decreases the sensitivity, specificity and accuracy of T/S and T/H for detecting breast cancer.

In the reproducibility tests, T/H is significantly the best one. The T/N has bad reproducibility, because some facts affect the T/N value. These facts include the region of the mass, the tumor ability of intense uptake of ^{99m}Tc-MIBI, the doctor's habit and knowledge etc. If using the T/N value to caculate some other parameters, the result may create bigger differences.

5 CONCLUSION

The T/N has the best sensitivity, specificity and accuracy for detecting the breast cancer, but its reproducibility is poor. The T/H value has better reproducibility.

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