Diagnostic value of ^{18}F-FDG PET/CT in detecting distant lymph node metastasis of gynecological malignancies.

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Abstract

Objective: To explore the value of ^{18}F-deoxyglucose (^{18}F-FDG) PET/CT in diagnosing distant lymph node metastasis of gynecological malignancies.

Method: 28 patients, initially confirmed with gynecological malignancies using pathological examination and other examinations-related, were enrolled in the study. They all underwent operation, and received preoperative ^{18}F-FDG PET/CT scan and postoperative pathological examination. The findings of pathological examination were defined as the golden standard of diagnosis. The accuracy, specialty, and sensitivity of the routine CT and ^{18}F-FDG PET/CT in diagnosing distant lymph node metastasis were counted. The maximal standard uptake value (SUX$_{max}$) of the patients with or without distant lymph node metastasis was compared.

Results: In 28 patients with gynecological malignancies diagnosed by postoperative pathological examination, 13 (46.43%) were confirmed with distal lymph node metastasis, and 15 (53.57%) without it. The accuracy, specialty, and sensitivity of ^{18}F-FDG PET/CT was 82.14%, 100.00%, and 61.54% in separate, and that of the routine CT which was 50.00%, 73.33%, and 23.08%, respectively. ^{18}F-FDG PET/CT had higher accuracy, specialty, and sensitivity than the routine CT, with a significant difference (P<0.05). Compared the SUV$_{max}$ in the patients with or without distant lymph node metastasis, there was no statistical difference (P>0.05).

Conclusion: ^{18}F-FDG PET/CT has higher accuracy in detecting distant lymph node metastasis of gynecological malignancies, and provides favorable guidance for clinical practice, deserving spread.

Keywords: Gynecological malignancies, Imaging, Lymph node metastasis, ^{18}F-deoxyglucose.

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Introduction

Gynecological malignancies are extremely harmful to female's health, lives, and quality of life, demanding timely diagnosis and treatment. According to the American Cancer Society statistics, 52630 cases of uterine cancer, and 21980 cases of ovarian cancer were diagnosed in 2014 [1]. A study [2] finds lymph node metastasis is a main way that gynecological malignancies transport, so gaining its knowledge plays a key role in drafting reasonable therapeutic regimen. Lymph node metastasis is an important prognostic factor, and the survival rates of patients with metastases to the nodes are significantly lower than those of patients without nodal metastases [3]. At present, more imaging methods can be applied for the detection of lymph node metastasis. Surgical lymph node assessment is the gold standard for the diagnosis of lymph node metastasis [4]. But surgical lymphadenectomy increases the time and cost of diagnosis and the risk of complications to the patient.

Currently, ^{18}F Fluorodeoxyglucose (FDG) Positron Emission Tomography (PET)/Computed Tomography (CT) is widely used in clinical evaluation of cancers [5-9]. Through comparison, this study has explored the value of ^{18}F-FDG PET/CT scan in diagnosing the distant lymph node metastasis of gynecological malignancies.

Data and Methods

General data

28 patients selected from those with gynecological malignancies initially diagnosed by pathological examination and other examinations-related from August 2015 to December 2016 were enrolled in the study, aging from 29 to 77 y, with a mean age of (53.15 ± 7.95 y).

Among them, 17 patients had got cervical cancer, 4 endometrial carcinoma, and 7 ovarian cancers. Inclusive

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criteria: being in accordance with its diagnosis standards; no surgical contraindications; no chemotherapy history; the patients signed the informed consent. Exclusive criteria: the vital organs with severe dysfunction; incomplete medical records; coagulation disorders. This research was approved by the Ethical Committee of third affiliated hospital of Qiqihar medical college according to the declaration of Helsinki promulgated in 1964 as amended in 1996, the approval number is 2016001.

Method

The study used the Discovery LS ^{18}F-FDG PET/CT (America GE cooperation).

The PET of combing imaging system consists of 18 rings prober, equipped with 64 channels helical CT scanner. ^{18}F-FDG was produced using a cyclotron provided by Sumitomo, with a radiochemical purity of 96% more. All participants had fasted over 4 h before operation. The ^{18}F-FDG would be injected after their blood sugar levels were ascertained ≤ 7.0 mmol/L through regular monitoring. Before injection, they must be on bed rest for 15 min in a dark and quite room. After injected a dose of 296~370 MBq (8~10 mC$_i$) ^{18}F-FDG, they also had to be on bed rest for 40 min. The researches asked the patients to urinate, and gave them PET and CT scan from the vertex to the middle part of thigh. The patients underwent CT scan firstly, with 140 kV voltage, 90 mA current, 0.3 s/circle, 512 × 512 array (it turned to 128 × 128 at the time of image fusion), and 8 mm slice thickness. The images of PET scan were collected adopting two-dimensional methods, 2 min/bed, with 512 × 512 array, 6 beds in total.

Observation indexes two doctors with rich experience analysed the images using semi-quantitative analysis and vision (qualitative) method. If the intake of ^{18}F-FDG increased, SUV$_{max}$ was ≥ 2.5, and the short diameter ≥ 1 cm, that indicated lymph node metastasis.

If the intake of ^{18}F-FDG was normal, it suggested there was no lymph node metastasis. The golden standard was the postoperative pathologies. Additionally, the accuracy, specialty, and sensitivity of the routine CT and ^{18}F-FDG PET/CT in diagnosing distant lymph node metastasis was calculated. We also concluded the common sites where the distant metastasis of gynecological malignancies occurred, and compared the SUV$_{max}$ in the patients with or without distant lymph node metastasis.

Statistical analysis

All data were processed by software SPSS20.0. The measurement data expressed as mean ± SEM ($\bar{x} \pm s$) were analysed with t test; the enumeration data expressed as ratio (%) were analysed with χ^2 test. P <0.05 was considered statistically significant.

Results

Analysis on the detecting outcomes of the 28 patients

In the 28 patients with gynecological malignancies diagnosed by postoperative pathological examination, 13 (46.43%) were confirmed with distant lymph node metastasis, and 15 (53.57%) without it. In the 13 patients with distant lymph node metastasis, the preoperative ^{18}F-FDG PET/CT scan found 8 patients (28.57%) with distant metastasis. Among the 8 patients, 5 patients (62.5%) suffered cervical node metastasis, 2 (25.0%) mediastinal lymph node metastasis, and 1 (12.5%) infraclavicular node metastasis; 5 patients (17.86%) didn't suffer from lymph node metastasis. In the 13 patients, 3 (10.71%) were diagnosed with distant lymph node metastasis by preoperative CT scan, 10 (35.71%) without it. In the 15 patients, no one was confirmed with distant lymph node metastasis by preoperative ^{18}F-FDG PET/CT, but 11 (35.71%) without the disorder by preoperative CT. The accuracy, specialty, and sensitivity of ^{18}F-FDG PET/CT was 82.14%, 100.00%, and 61.54% in separate, and that of the routine CT which was 50.00%, 73.33%, and 23.08%, respectively. Therefore, ^{18}F-FDG PET/CT had higher accuracy, specialty, and sensitivity than the routine CT, with a significant difference (P<0.05, Table 1).

Table 1. Comparison on the accuracy, specialty, and sensitivity of two diagnosis method for 28 patients (%).

Methods	Accuracy	Specificity	Sensitivity
^{18}F-FDG PET/CT	82.14 (23/28)[a]	100.00 (15/15)[a]	61.54 (8/13)[a]
CT	50.00 (14/28)	73.33 (11/15)	23.08 (3/13)
χ^2	6.452	4.615	3.939
P	0.011	0.032	0.047

Note: compared with CT, [a]P<0.05

Comparison on the SUV$_{max}$ of various patients

Compared the SUX$_{max}$ of the patients with distant lymph node metastasis or not, there was no statistical difference (P>0.05, Table 2).

Table 2. Comparison on the SUX$_{max}$ of the patients with distant lymph node metastasis or not ($\bar{x} \pm s$).

Condition of distant lymph node metastasis	Number of cases	SUV$_{max}$
With distant lymph node metastasis	13	8.01 ± 2.32[a]
Without distant lymph node metastasis	15	6.70 ± 2.15
t		1.550
P		0.133

Note: compared with the patients without distant lymph node metastasis, [a]P>0.05

Discussion

How to address the lymph nodes in proper is a key for the treatment of gynecological malignancies, and mastering the condition of lymph node metastasis before surgery may provide a reference for determining operation methods, surgery extent, and adjunctive therapies, enhancing the curative effect [10]. Presently, in the light of the short diameter of lymph node>1.0 cm or not, CT and MRI determine whether the lymph node is benign or malignant. In recent years, with enhancement scanning gradually used in clinic, CT and MRI provide more accurate information for lymph node metastasis on the methods and level of lymph node enhancement, while the metastatic lymph nodes lack enhancement features to an extent, so it still has some limitations [11]. Compared with the common imaging methods, ^{18}F-FDG PET/CT imaging can supplies high resolution anatomic images, meanwhile, show the change of cellular function and metabolism, and then increase the accuracy in diagnosing lymph node metastasis [12]. Many researches [13,14] in China has proved that ^{18}F-FDG PET/CT imaging takes more advantages in detecting lymph node metastasis of gynecological malignancies than the common imaging. Some scholars conduct a study involving 30 patients with gynecological malignancies and find that the accuracy of ^{18}F-FDG PET/CT in diagnosing the retroperitoneal lymph node metastasis is 83.3%, and the specialty and positive predictive value reach 100% [15]. In the present study, the accuracy, specialty, and sensitivity of the preoperative ^{18}F-FDG PET/CT for the patients with gynecological malignancies is 82.14%, 100.00%, and 61.54% in separate, and that of the routine CT which is 50.00%, 73.33%, and 23.08%, respectively. ^{18}F-FDG PET/CT has higher accuracy, specialty, and sensitivity than the routine CT, with a significant difference (P<0.05), which is consistent with the above reports. But some scholars point out [16], ^{18}F-FDG PET/CT still has some shortages, for example, its results are prone to be impacted by the physiological activities of urinary system and intestinal canals; and it will be absorbed and dissolved by inflammatory cells and granulation tissues.

In a word, due to scan the whole body's lymph nodes, ^{18}F-FDG PET/CT has higher detection rate on the distant lymph node metastasis in the sites beyond abdominopelvic cavity than the common CT scanning a single site. Furthermore, the diagnosis based on the increase intake of ^{18}F-FDG in metastatic sites is more accurate than the CT examination relying on the size of lymph nodes, which offers essential message to clinic diagnosis and treatment, with higher value. But the study refers to small sample size, the findings needs further investigation.

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