

Features of the Visualization of Different Histologic Types of Hodgkin's Lymphoma p about Positron Emission Tomography Combined with Computed Tomography

Subbotin AS^{1*} and Afanasyev NG²

- 1 Clinical Oncology Center, State Budgetary Health Institution, Chelyabinsk, Russian Federation
- 2 FGBOU South Ural State Medical University of the Ministry of Health of the Russian Federation, Chelyabinsk, Russian Federation

*Corresponding author: Subbotin AS

✉ acsubbotin@yandex.ru

Clinical Oncology Center, State Budgetary Health Institution, Chelyabinsk, Russian Federation.

Tel: +201112139714

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Abstract

PET-CT is currently of significant clinical importance in Hodgkin's lymphoma and is used both for primary staging and tumor re-grading, and for assessing the dynamics of the treatment being performed. In the literature there are indications of the possibility of a lack of accumulation of the radiopharmaceutical in the tumor tissue in Hodgkin's lymphoma before the start of treatment. Low metabolic activity of the tumor tissue prior to treatment makes it difficult to assess the dynamics of the treatment, and when performing resaduring, it can mimic the complete metabolic response in the presence of viable tumor tissue. A study was conducted to determine the frequency of occurrence of low metabolic activity of tumor tissue in Hodgkin's lymphoma. Retrospectively, the results of 131 PET-CT whole-body studies with 18 F - fluorodeoxyglucose were performed on patients with histologically verified Hodgkin lymphoma. The characteristics of the accumulation of 18 F - fluorodeoxyglucose in various histological types of Hodgkin's lymphoma were studied, the dependence of the level of metabolic activity on the presence of general symptoms of intoxication was determined. According to the data obtained, low metabolic activity was determined in 4% of patients with Hodgkin's lymphoma. The highest levels of metabolic activity were determined in case of nodular sclerosis, the lowest - in Hodgkin's nodular lymphoma with lymphoid predominance. Patients with common symptoms were characterized by higher levels of metabolic activity.

Keywords: Hodgkin's lymphoma; PET-CT; 18-fluorodeoxyglucose

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Introduction

Lymphoma Hodgkin's considered malignant neoplasm with high curable. Complete cure is achieved in 80-90% of patients with localized stages and in 60-70% of patients with common stages of the disease. Good results in the treatment of Hodgkin's lymphoma are a result of the high efficacy of modern chemotherapy and radiotherapy regimens. However, with long-term follow-up of patients treated for Hodgkin's lymphoma, it became apparent that there were a large number of long-term effects of treatment, such as the development of second tumors, complications of the cardiovascular and respiratory systems, which shorten the patient's life expectancy [1]. At the same time, the failure of the treatment is accompanied by the development of relapses of Hodgkin's lymphoma, which are

more difficult to treat and in some cases are refractory to any of the applied methods of treatment [2]. The balance between the adequacy of the treatment and its safety is the basis of tactics in the fight against Hodgkin's lymphoma. An important link in the management of patients with Hodgkin's lymphoma is the primary staging of the tumor process [3-6]. A number of studies indicate the possibility of no signs of an increase in metabolic activity in tumor tissue in Hodgkin's lymphoma in 1-3% of cases before the start of treatment [7-10]. The presence or absence of an increased level of FDG accumulation in the tumor tissue at the primary staging affects the ability to assess the dynamics of the treatment. Studying the characteristics of FDG accumulation in tumor tissue in various histological types of Hodgkin's lymphoma would optimize the assessment of treatment dynamics by identifying tumor variants that are prone to lower SUVmax values

during initial staging, and as a result, a more careful interpretation of the results of treatment dynamics assessment. The literature does not provide information regarding the features of the accumulation of FDG in various histological types of Hodgkin's lymphoma and analysis of the possible causes of the low level of metabolic activity of tumor tissue in this disease.

Objective

To study the characteristics of FDG accumulation in tumor tissue in various histological variants of Hodge Kin 's lymphoma at primary staging, to determine the proportion of patients with Hodgkin's lymphoma with low metabolic activity of the tumor tissue before the start of treatment.

Methods

In the PET center GBUZ CHOKOD for the period 2011-2015. 131 PET-CT studies were conducted with the aim of primary staging in patients with Hodgkin's lymphoma. All cases were verified by histological and immunohistochemical methods. Female patients prevailed (69 patients - 53%). Histological types distribution was as follows: class and Th Skye Hodgkin 123 patients (94%) nodular sclerosis - 68 patients (52%), mixed-cell variant - 35 patients (27%), lymphoid depletion - 13 patients (10%), lymphoid predominance - 7 patients (5%) ; non-classical Hodgkin's lymphoma: Hodgkin's nodular lymphoma with a lymphoid predominance (NLHLP) - 8 patients (6%). 64 patients had no common symptoms of Hodgkin's lymphoma ("B-symptoms"), 67 patients had common symptoms caused by a tumor process.

The study was conducted according to standard methods. Preparation for the study included a light, carbohydrate-free dinner, the last meal no earlier than 8 hours before the study. Patients before the introduction of FDG was carried out glycemic control. FDG was administered in a volume with an activity of 200 MBq per square meter of the patient's body surface. The duration of the distribution of the radiopharmaceutical was 60-120 minutes. Scanning began with the native phase of the MSCT study, then PET scan was performed with the scan area divided into 5-6 "beds" with a scan duration of 3 minutes each. After that, an intravenous bolus of iodine-containing monomeric non-ionic contrast medium was administered in a volume of 100-150 ml and the arterial and venous phases of MSCT were scanned. Evaluation of the metabolic activity of pathological foci was carried out by measuring the index SUVmax, as well as its comparison with the index SUVmax in the liver parenchyma.

For the purpose of statistical processing of the material, the calculation of the average error of the mean value m by the formula was applied:

$$m = \frac{\delta}{\sqrt{n}}$$

where m is the average error of the mean, δ is the standard deviation, n is the number of observations. The standard deviation was calculated by the formulas:

$$\delta = \sqrt{\frac{\sum(x-M)^2}{n}}$$

For observations in which $n \geq 30$ and

$$\delta = \sqrt{\frac{\sum(x-M)^2}{n-1}}$$

For observations in which $n < 30$, where x is the value of the series variable, M is the arithmetic average of all variables of the series.

Results and Discussion

The following results were obtained **Table 1**. In 5 patients (4%) in the affected lymph nodes the accumulation of FDG was determined to be equal to or less than the accumulation of FDG by the liver parenchyma. In all cases, there was an increase in the lymph nodes of the affected groups. It should be noted that all patients with a low metabolic activity of the affected lymph nodes no symptoms of intoxication ("B symptoms"). Of these 5 patients, a complete absence of signs of increased metabolic activity in pathologically changed lymph nodes was determined in 3 patients (2%), of which 2 patients tested the mixed-cell variant of Hodgkin's lymphoma, in 1 case the Hodgkin's nodular lymphoma with lymphoid predominance. One patient with metabolically inactive lymph nodes affected by the mixed-cell variant of Hodgkin's lymphoma had HIV infection. The second patient with metabolically inactive lymph nodes with the presence of a verified biopsy material from them, confirming the presence of a mixed-cell variant of Hodgkin's lymphoma, did not have any distinctive features in the history. A patient with a metabolically inactive Nodular Hodgkin's lymphoma with lymphoid predominance noted an increase in lymph lymphomas in the course of several years.

In patients without "B-symptoms," the range of SUVmax in tumor masses ranged from 1.4 to 22.5, the average value was 10.1 ± 0.8 . In patients with "B-symptoms", the range of SUVmax ranged from 5.3 to 40.0, on average - 16.3 ± 0.9 .

In most cases, Hodgkin's lymphoma is characterized by a high level of FDG accumulation, commensurate with FDG accumulation of aggressive non-Hodgkin's lymphomas. Given the small fraction of Berezovsky-Sternberg-Reed tumor cells in the tumor masses, the high accumulation of FDG cannot be explained by the active glycolysis processes in these cells. Accordingly, the hypermetabolism of the tumor tissue is most likely due to an active metabolism in the cells of the microenvironment that secrete a large amount of biologically active substances. The biochemical processes occurring in tumor tissue in Hodgkin's lymphoma are similar to active inflammatory processes, in which active utilization of FDG is also observed. Consequently, most likely a high level of FDG absorption in Hodgina lymphoma is associated with the activity of normal immunocompetent body cells that form the microenvironment for few tumor cells. This theory is confirmed by the fact that patients with the presence of common symptoms in Hodgkin's lymphoma have a higher level of metabolic activity in tumor masses in comparison with patients in whom the disease proceeds without clinically severe intoxication. All variants of classical Hodgkin's lymphoma are characterized by a commensurate high level of metabolic activity, with non-classical Hodgkin's lymphoma, the level of metabolic activity is on average somewhat lower, which can be explained by the greater

Table 1 Features of the metabolic activity of various histological variants of Hodgkin's lymphoma.

Histological type (N - number of patients)	The minimum SUVmax value in the range	The maximum value of SUVmax in the range	Average SUVmax ($\pm m$)	The number of patients with SUVmax in the affected structures is equal to or lower than the liver SUVmax
All types (N=131)	1.4	40.0	14.1 \pm 0.6	Five
Nodular sclerosis (N= 68)	2.7	40.0	14.2 \pm 0.9	One
Mixed cellvariant (N=35)	1.4	26.0	13.1 \pm 1.1	2
Lymphoid depletion (N=13)	3.2	22.5	12.5 \pm 2.2	One
Lymphoid predominance (N=7)	6.6	12.2	11.0 \pm 3.4	0
Nodular Hodgkin's lymphoma with lymphoid predominance (N=8)	1.6	20.0	9.8 \pm 2.1	One

tendency of NLHLP to an indolent clinical course.

A higher average level of FDG accumulation in tumor masses in patients with the presence of "B-symptoms" can be explained by the greater activity of the tumor process.

Conclusion

For lymphomas, Hodgkin's is characteristic of a high metabolic activity of tumor masses. Classical Hodgkin's lymphoma is characterized by high metabolic activity, comparable to all four variants, the metabolic activity of non-classical Hodgkin's lymphoma is on average somewhat lower than the metabolic activity of the classical variants. In the group of patients with

clinically severe intoxication, the level of metabolic activity of the tumor masses was higher than in the group of patients with Hodgkin's lymphoma without "B-symptoms". For a more accurate assessment of the dynamics of the treatment of Hodgkin's lymphoma, it is more expedient to perform primary staging prior to initiating therapy, since in some cases the initial low accumulation of FDG in tumor masses may mimic the absence of viable tumor tissue in the affected lymph nodes when assessing the dynamics of treatment.

Conflict of Interest

Authors declare no conflicts of interest arising from writing conflicts of interest.

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