PERIÓDICO TCHÊ QUÍMICA
ARTIGO ORIGINAL

# ANÁLISE RETROSPECTIVA DO CURSO DE CÂNCER DE TIREÓIDE COM METÁSTASES NOS PULMÕES APÓS RADIODIOTERAPIA

# RETROSPECTIVE ANALYSIS OF THE COURSE OF THYROID CARCINOMA WITH LUNG METASTASES AFTER RADIOIODINE THERAPY

# РЕТРОСПЕКТИВНИЙ АНАЛІЗ ПЕРЕБІГУ РАКУ ЩИТОВИДНОЇ ЗАЛОЗИ З МЕТАСТАЗАМИ В ЛЕГЕНЯХ ПІСЛЯ РАДІОЙОДТЕРАПІЇ

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## RESUMO

As metástases de tumores malignos são um dos problemas mais agudos da oncologia. Por frequência de lesões entre os órgãos e sistemas do corpo humano, um dos primeiros locais é ocupado pelos pulmões, o que provavelmente está intimamente relacionado às características anatômicas de sua estrutura e fisiologia. No primeiro exame de pacientes com câncer, as metástases pulmonares são encontradas em 6 a 15%, metástases linfogênicas – em 50 a 81%. No carcinoma diferenciado da glândula tireóide (glândula tireóide) muitas vezes se encontram as metástases nos pulmões (até 15% dos casos). Ao mesmo tempo, as taxas de sobrevida de 5 e 10 anos são de 50 a 92,6% e 42 a 86%, respectivamente. O uso de iodeto de sódio (131I) é a base para o tratamento desses pacientes. O objetivo do artigo é estudar a eficácia da terapia com radioiodo em metástases de carcinoma de tireóide nos pulmões. Utilizamos os métodos radiológicos clínicos, laboratoriais para diagnosticar carcinoma de tireóide e metástases pulmonares. De 1986 a 2010, o estudo envolveu 68 pacientes da clínica do S. P. Hryhoriiev Instituto de Radiologia Médica de Academia de Ciências Médicas da Ucrânia. Metástases pulmonares foram encontradas em pacientes com todos os estágios da doença e com diferentes tamanhos de tumor primário da tireóide. Após o tratamento cirúrgico, os pacientes receberam iodeto de sódio (131I) em várias doses de radioatividade. O efeito terapêutico completo da radioterapia foi alcançado em 5 pacientes (7,8%) durante o período de tratamento de 3 anos e no período de 5 anos - em 28 (43,8%); estabilização ou efeito parcial foi observado em 24 pacientes (37,8%), progressão da doença em 12 pacientes (17,6%). A mortalidade por progressão da doença foi de 12,5%

**Palavras-chave**: *minimização de energia potencial, método dos elementos finitos, isolamento térmico, temperatura, coeficiente de transferência de calor.*

## ABSTRACT

Metastasis of malignant tumors are one of the most acute problems of oncology. Among the organs and systems of the human body in terms of frequency of damage, one of the first places is occupied by the lungs, which is probably closely related to the anatomical features of their structure and physiology. During the first examination of cancer patients, metastases in the lungs are revealed in 6-15%, lymphogenous metastases are observed in 50-81%. With differentiated thyroid carcinoma (thyroid gland), metastases in the lung are most often detected (up to 15% of cases). At the same time, 5- and 10-year survival rates are 50-92.6% and 42-86%, respectively. The use of 131I-sodium iodide is central to the treatment of these patients. The purpose of the paper is to study the effectiveness of radioiodine therapy for metastases of thyroid carcinoma in the lung. We used clinical, laboratory, radiological methods for the diagnosis of thyroid carcinoma and pulmonary metastases. From 1986 to 2010, 68 patients from the clinic of the S.P. Hryhoriev Institute of Medical Radiology of the Academy of Medical Sciences of Ukraine were included in the study. Lung metastases were found in patients with all stages of the disease and with diverse sizes of the primary thyroid tumor. After the surgical treatment of patients, 131I-sodium iodide was used in various doses of radioactivity. The full therapeutic effect of radiotherapy was achieved in 5 patients (7.8%) over a 3-year period of treatment, and a 5-year period – in 28 (43.8%); stabilization or partial

effect was noted in 24 patients (37.8%), disease progression was observed in 12 patients (17.6%). Mortality from disease progression was 12.5%.

**Keywords**: *differentiated thyroid carcinoma, lung metastases, radioiodine therapy.*

## АНОТАЦІЯ

Метастази злоякісних пухлин є однією з найбільш гострих проблем онкології. Серед органів і систем організму людини за частотою ушкоджень одне з перших місць займають легені, що, ймовірно, тісно пов'язано з анатомічними особливостями їх будови і фізіології. При першому обстеженні хворих на рак метастази в легені виявляють у 6-15%, лімфогенні метастази - у 50-81%. При диференційованій карциномі щитовидної залози (щитовидна залоза) найчастіше виявляються метастази в легенях (до 15% випадків). У той же час 5- і 10-річна виживаність становить 50-92.6% і 42-86% відповідно. Використання 131I-йодиду натрію є основою для лікування цих пацієнтів. Метою статті є вивчення ефективності радіойодтерапії при метастазах карциноми щитовидної залози в легенях. Ми використовували клінічні, лабораторні, рентгенологічні методи діагностики карциноми щитовидної залози і легеневих метастазів. З 1986 по 2010 рік в дослідженні брали участь 68 пацієнтів з клініки Інституту медичної радіології ім. С.П. Григор'єва АМН України. Метастази в легенях були виявлені у пацієнтів з усіма стадіями захворювання і з різними розмірами первинної пухлини щитовидної залози. Після хірургічного лікування пацієнтів застосовували 131I-йодид натрію в різних дозах радіоактивності. Повний терапевтичний ефект променевої терапії досягнуто у 5 пацієнтів (7,8%) протягом 3-річного періоду лікування, а 5-річного періоду - у 28 (43,8%); стабілізація або частковий ефект відзначено у 24 пацієнтів (37,8%), прогресування захворювання спостерігалося у 12 пацієнтів (17,6%). Смертність від прогресування хвороби становила 12,5%.

**Ключові слова:** *диференційована тироїдна карцинома, легеневі метастази, радіойодтерапія.*

## 1. INTRODUCTION

Metastasis of malignant tumors are one of the pressing issues of clinical oncology. Often, distant metastases are detected in the process of examination of primary patients or at different times after the treatment of malignant neoplasms localized in the lungs. Upon examining lung metastases, 6–30% of patients with tumors of different localization are determined, mainly in kidney, breast, chorionepithelioma, tumors of the testis, and sarcomas, rarely – in tumors of other localizations (Paches and Prop, 1995; Valdina, 2001).

In many patients, the process of metastasis begins long before the detection of the primary tumor and the initial distant micrometastases, which are not always found with the use of modern research methods. In the lungs, approximately 38% of all distant metastases of cancers of different localization are identified (Paches and Prop, 1995; Schlumberger and Pacini, 1999; Valdina, 2001).

Among the organs and systems of the body, lungs occupy an important place in the frequency of metastatic lesions in malignant neoplasms of different locations (Schlumberger, 1998; Valdina, 2001; Drozdovsky *et al*., 2002; Podolkhova *et al*., 2006). At the initial examination, lung metastases (LM) reveal, according to various authors, 6-15% of patients with malignant tumors, and after treatment, in the event of progression of the process, as a rule, the lungs are affected in most cases (Paches and Prop, 1995; Valdina, 2001; Vini and Harmer, 2003; Afanasieva, 2004). LM are spread by the lymph-hematogenous pathway in 50.0–81.8% of cases, rarely by hematogenous (9.4–30.2%) and lymphogenous (4.3–23.5%) pathways (Valdina, 2001; Lin *et al*., 2004; Bachelot *et al*., 2005; Dadu and Cabanillas, 2012; Marotta *et al*., 2013; Chopra *et al*., 2015; Kudabaeva *et al*., 2016; Gorbas *et al*., 2015).

The share of thyroid carcinoma is 0.4–2.0% (Schlumberger *et al*., 1996; Schlumberger and Pacini, 1999; Afanasyeva, 2006). of all malignant tumors. Over the last decade, the incidence of thyroid carcinoma has notably increased (Paches and Prop, 1995; Vini and Harmer, 2003). Long-term metastases in patients with thyroid carcinoma are observed in 7.1–17.0% of cases (Schlumberger and Pacini, 1999; Tzavara *et al*., 1999; Blagitko *et al*., 2003; Garbuzov, 2003; Afanasyeva, 2006; Smiyan *et al*., 2015).

Lungs are more often the sites of distant metastasis – from 4.4 to 15.0% (Paches, 2000; Kozak *et al*., 2004). According to the data in the domestic and foreign literature, the 5- and 10-year

survival of patients with differentiated thyroid carcinoma (DTC) with lung metastases after radioiodine therapy (RIT) is 50.0-92.6% and 42-86%, respectively. In the case of combined lesion of the lungs and mediastinal lymph nodes – 88% and 72%, respectively (Valdina, 2001; Drozdovsky *et al*., 2002; Garbuzov, 2003; Afanasieva, 2004; Kozak *et al*., 2004; Huang *et al*., 2012; Schneider and Chen, 2013; Kudabayeva *et al*., 2017; Burkitbaev *et al*., 2017). The use of 131I has a leading role in the treatment of remote metastases of the thyroid gland.

The full effect of treatment was noted in the absence of ultrasound signs of local and regional recurrence in the absence of pathological lesions on the lung radiograph, physiological distribution of the isotope in scintigraphy, and normalization of thyroglobulin level. Incomplete (partial) treatment or stabilization effects were determined if, in the presence of local and regional recurrence, the size of the tumor was reduced, the size of lung metastases decreased or stabilized, and the titration of thyroglobulin decreased. The absence of effect or disease progression was assessed with recurrence of a neck tumor, enlargement of metastatic lesions in the lungs and/or mediastinum, and/or multiple lung metastases. The conventional method of treatment of such patients involves oral administration of empirical activities of radioiodine in several stages with an interval of 6 months and more until complete visualization of the metastatic lesion has disappeared (Afanasyeva, 2006; Podolkhova *et al*., 2006; Mechev *et al*., 2010; Nixon *et al*., 2012; Kim *et al*., 2014; Song *et al*., 2015; Burkitbaiev *et al*., 2017) technique of systematic repetition of courses of treatment with a continuous increase of radioiodine activity with each subsequent stage of treatment allows neutralizing the effect of the so-called "stunning", or damping of thyroid tissue. The successive graded increase in therapeutic activity makes it possible to effectively overcome the threshold of increased radioresistance of those groups of thyroid cells that remained intact after the previous stage of the RIT. The sharp reduction in the time of the summation of the total therapeutic activity (for 9 months, but not for the classic 2-3 years) allows maximizing the effect of preserving the radiosensitivity of thyroid cells, which are lost during prolonged courses of radioiodine therapy (Mechev *et al*., 2010).

The use of 131I has a leading role in the diagnosis and treatment of remote metastases of the thyroid gland (Paches and Prop, 1995; Tzavara *et al*., 1999; Valdina, 2001; Drozdovsky *et al*., 2002; Vini and Harmer, 2003; Afanasyeva, 2006; Podolkhova *et al*., 2006). The RIT technique is based on the mechanism of active accumulation of 131I in thyroid tumor cells, which allows achieving a high absorbed dose in focus with minimal radiation load on the surrounding tissues (Drozdovsky *et al*., 2002; Vini and Harmer, 2003; Kudabaeva *et al*., 2015; Abdrakhmanova *et al*., 2019).

The problems of RIT in patients with thyroid carcinoma with distant metastases are defined – the diagnosis and treatment of metastases, devitalization of thyroid tissue after surgical treatment. This reduces the risk of local recurrence and uses thyroglobulin (TG) as a tumor marker (Kisileva *et al*., 1987; Paches and Prop, 1995; Reiners and Farahati, 1999; Schlumberger and Pacini, 1999; Drozdovsky *et al*., 2002; Vini and Harmer, 2003; Kozak *et al*., 2004; Afanasyeva, 2006; Mechev *et al*., 2010; Drozdovsky and Podolkhova, 2007; Ramilyeva *et al*., 2019).

To determine the prevalence of thyroid carcinoma, research methods such as computed tomography of the neck and lungs with contrast in the presence of radiolucent and functionally active lung metastases are used; study of thyroglobulin levels and its antibodies (furthermore, for early diagnosis of thyroid carcinoma relapse) (Paches, 2000; Valdina, 2001; Drozdovsky *et al*., 2002; Afanasieva, 2004; Tkachenko *et al*., 2005; Afanasyeva, 2006).

According to the treatment protocol, patients with differentiated thyroid carcinoma in the presence of lung metastases undergo several courses of RIT with the aim of the destruction of all metastatic lesions capable of accumulating radioiodine. For adults, radioiodine treatment activities can reach 24 GBq for a single RIT course. Lung metastases can be detected after several courses of treatment: after partial or complete ablation of residual thyroid tissue or lymph node metastases (Valdina, 2001; Paches and Prop, 1995; Podolkhova *et al*., 2006 Afanasieva, 2004; Kozak *et al*., 2004; Drozdovsky and Podolkhova, 2007) in adult patients with lung metastases up to 14% of the total number of patients with thyroid carcinoma. To reduce the level of thyroglobulin and ablation of metastases, several courses of RT are necessary (Afanasieva, 2004; Kozak *et al*., 2004; Podolkhova *et al*., 2006; Drozdovsky and Podolkhova, 2007; Mechev *et al*., 2010). Typically, in practice, therapeutic activity in the treatment of thyroid carcinoma is determined empirically. If distant metastases are detected at the first diagnostic scan, they use the activity of about 6,000 MBq (Kozak *et al*., 2004). Some authors believe that to achieve the maximum

therapeutic effect, and one can use the highest activities that the patient can tolerate without complications caused by radiation (Reiners and Farahati, 1999; Tzavara *et al*., 1999; Podolkhova *et al*., 2006). However, the result of treatment depends on such factors as the histological structure of the tumor, the patient's age, the number and size of lymph node metastases, the size of the residual tissue of the thyroid gland, etc. It was proven, however, that the course of treatment is substantially determined by the magnitude of the first and second activity, the duration of the break between courses of radioiodine (Kisileva *et al*., 1987; Reiners and Farahati, 1999; Kozak *et al*., 2004; Mechev *et al*., 2010; Drozdovsky and Podolkhova, 2007x).

The purpose of the study is to investigate the efficiency of radioiodine therapy of thyroid carcinoma metastases in the lung.

## 2. MATERIALS AND METHODS

The computer database of the clinic provided a retrospective analysis of the clinical data, the nature of the course of thyroid cancer in the process of cancer treatment, and the results of follow-up care for 68 patients with lung metastases after completion of treatment from 1986 to 2018.

Statistical processing used Fisher's exact test using the Biostatistica software package, v. 4.03. The accuracy of the diagnostic test was analyzed by determining the sensitivity and specificity as the operational characteristics of the diagnostic method. The survey included a group of patients, making up 51 women (73.5%) and 17 men (26.5%) aged 16 to 68 years (median age – 50.5 years).

The distribution of patients is presented in Table 1. The histological structure of thyroid carcinoma in 53 cases (77.9%) revealed papillary carcinoma in 9 cases (13.2%) – follicular carcinoma, papillary carcinoma, follicular variant – in 6 patients (8.9%), medullary carcinoma – 7 patients (8.8% of cases). Background benign thyroid pathology was observed in 18 patients (28% of cases). Oncological heredity was found in 14 patients (22.8% of cases).

The patients underwent single or multiple surgeries. The distribution of patients by the nature of the intervention is presented in Table 2.

The duration of treatment ranged from 1 to 26 years. The prevalence of primary tumor, according to the international TNM classification, was found in 51 patients (79.7% of cases). In 13 patients (20.3% of cases), TX was observed. Most patients – 17 patients (26.6% of cases) had a T2 size tumor; T3 and T4 were found in 13 patients each (20% of cases). Lymph nodes at the time of diagnosis were observed in 42 patients (66% of cases). That is, in 36 cases (56.2% of patients), which is almost half of patients, they received radical surgical treatment. Also, in 23.4% of cases, patients underwent supplementary surgery – a finishing thyroidectomy, which was accompanied by additional anesthesia, which was recognized as a negative factor for the cardiovascular and nervous systems in elderly patients.

According to the stage of the disease, patients were allocated as follows: stage I – in 19 patients (29.7% of cases); II – in 14 (21.9% of cases); III – in 14 (21.9% of cases); stage IV – in 17 patients (26.6% of cases). Pulmonary metastases at the time of diagnosis were detected radiographically in 18 patients (28.7% of cases), the presence of metastatic lung lesions in the latter patients was further discovered upon chest scintigraphy on “residual” activities 131I after issuing therapeutic activities 131I, or radiologically. Data on a primary diagnosis of pulmonary metastases are presented in Table 3.

Four weeks before the radiotherapy, hormone therapy was canceled. The level of thyrotropin in the serum of patients before treatment ranged from 18 to 53 mIU/L (the norm is 0.3–4.0). Thyroglobulin titre was elevated in 53 patients (82.8% of cases).

All patients underwent RIT, the activity of radiopharmaceutical agents for one course ranged from 1.110 to 7.030 MBq. Total activity throughout the treatment period was in the range of 11,740–43.586 MBq. Suppressive hormone therapy was renewed after 48-72 hours. By reducing the radiation dose rate to 3 μSv/h at a distance of 1 meter from the patient, whole-body scintigraphy was performed on “residual” activities on the Ohio-nuclear gamma camera to detect the centers of accumulation of radiopharmaceutical agents. Follow-up RIT courses were conducted in 3-6 months. Treatment continued until the complete absence of foci of radioiodine accumulation, radiological signs of the disease, and normalization of the level of thyroglobulin content in the serum.

The full effect of treatment was determined in the absence of ultrasound signs of local or regional recurrence, in the absence of pathological lesions of the X-ray image, as well as foci of accumulation of radioiodine on whole body scintigrams on “residual” activities of $^{131}$I, normalization of the level of thyroglobulin in

patients' serum.

During the observation period, 8 patients (12.5%) died from localized relapse and distant metastasis of thyroid carcinoma. The studies were performed under the supervision of the local ethics committee for clinical and experimental research at the S.P. Hryhoriev Institute of Medical Radiology of the Academy of Medical Sciences of Ukraine with obtaining patients' consent to use information.

## 3. RESULTS AND DISCUSSION:

The full effect of RIT over the 3-year treatment period was achieved in 5 patients (7.8%), with the total introduced the activity of 131I varying from 7.030 to 16.720 MBq (number of courses 3-5). This indicates different levels of radiosensitivity of tumor cells, which is confirmed by studies of other authors (Kisileva *et al*., 1987; Paches and Prop, 1995; Valdina, 2001; Kozak *et al*., 2004; Afanasieva, 2004; Podolkhova *et al*., 2006).

Accumulation of radioiodine only at the site of "residual" thyroid tissue was observed in 14 patients (21.9% of cases) with radiographic signs of lung metastases. The total therapeutic activity of radiopharmaceutical agents in these cases ranged from 1,110 to 3,700 MBq.

The accumulation of radiopharmaceutical agents in the "residual" thyroid tissue and lungs was observed in 31 patients (42.2% of cases – that is, a partial therapeutic effect). Radioiodine fixation in the lungs alone was established in 14 cases (21.8%). The accumulation of 131I in the lymph nodes of the neck and the remains of the thyroid gland – in 3 patients (4.7% of cases), in 1 case – in both the lungs and lymph nodes of the neck. That is, these patients experienced a local and long-term continuation of the disease. Therefore, they required further treatment.

For the 5 years, the full therapeutic effect was achieved in 28 patients (43.8% of cases), which corresponds to the data of some researchers (Kisileva *et al*., 1987; Reiners and Farahati, 1999; Afanasieva, 2004; Podolkhova *et al*., 2006; Drozdovsky and Podolkhova, 2007). Stabilization or partial effect of treatment was achieved in 24 patients (35.3% of cases); unfortunately, the progression of the disease (i.e., the occurrence of localized relapse, metastasis in the lymph nodes of the neck) was observed in 12 patients (18.8% of cases). Subsequently, 8 of them (12.5% of cases) died from progression of thyroid carcinoma (according to other authors, mortality ranged from 4.9% to 20.7%) (Podolkhova, 2006; Afanasyeva, 2006).

Therefore, in 2/3 of the patients, metastatic lesion of regional lymph nodes was observed before the start of treatment with 131I, which indicated an extra-organ distribution of primary thyroid tumor, which makes it advisable to conduct a more detailed radiological examination of patients at the diagnostic stage (CT of the neck and MRI of the lungs).

A considerable number of non-radical surgical interventions (almost 44%) make it necessary to improve diagnostic methods of verification of thyroid carcinoma (obligatory performance of a fine needle puncture biopsy of focal changes in the thyroid gland, assessment of the degree of vascularization of pathological lesions in the thyroid gland, altered by the size and structure of regional lymph nodes).

To illustrate the above material, below, clinical examples that characterize the features of the course of the thyroid gland at different stages of the established diagnosis are given, the unpredictable continuation of the disease, even in patients with a non-aggressive course of thyroid microcarcinoma is demonstrated.

Example 1. Patient P., born 1965. Diagnosis: papillary thyroid carcinoma pT1N0M0, after complex treatment, lung metastases, stage I, 2nd clinical group. Severe hypothyroidism.

Considers herself sick since June 2008, when she was ill with pleuropneumonia (received anti-inflammatory therapy in the outpatient clinic with), which was complicated by left-sided dry pleuritis. Upon bronchoscopy, no data on bronchial and lung oncopathology were noted. At the same time, ultrasound of the neck incidentally detected a node 1.0 x 0.8 cm in size in the right lobe of the thyroid gland, which resulted in an aspiration puncture biopsy of this neoplasm. Cytologically, data were obtained on the proliferation of the follicular epithelium. Therefore, surgical treatment is recommended. The patient went to the endocrinological clinic in Kharkiv, where she underwent thyroidectomy on June 25, 2008. PGV No. 2141-44 from 02.07.2008: encapsulated papillary microcarcinoma with a diameter of 1 cm. Further treatment of the patient continued at the S.P. Hryhoriev Institute of Medical Radiology of the Academy of Medical Sciences of Ukraine, where after checking the micro preparations, the carcinoma diagnosis was confirmed. As a result, on 14.08.2008, the patient received 131I treatment at 3.700 MBq for the medical purpose. After completing the

radiometrics, she had a scintigram of a section of the neck and chest at the “residual” activities of 131I, upon which fixation of radiopharmaceutical agents was observed only in the neck (Figure 1). Subsequently, the patient received suppressive hormone therapy with euthyrox at a dose of 225 μg per day (TSH level was 0.0105-0.08 mIU/L).

The control study of the patient after six months detected a significant increase in serum content of thyroglobulin and antibodies to it against the background of the abolition of hormone therapy (79.4 ng/ml and 326 IU/ml, respectively). The patient underwent X-ray computed tomography of the neck and chest, which revealed the presence of multiple metastases in the parenchyma of the lung (Figure 2). Therefore, on March 26, 2009, the patient received 131I treatment at 4,000 MBq for medical purposes. Scintigraphy of the neck and thorax area on the “residual” 131I activities revealed the accumulation of radioiodine in the lung parenchyma, indicating that the patient had functionally active metastases of thyroid carcinoma in the lung (Figure 3).

In November 2009 and June 2010, the patient received regular courses of radioiodine treatment. At the same time, after each course, there was an accumulation of radioiodine in the lung parenchyma. Currently, the patient receives a suppressive dose of euthyrox, is under the supervision of a regional oncologist.

This example demonstrates the unpredictable nature of the course of encapsulated microcarcinoma, and previous "pleuropneumonia" could be the first manifestation of lung metastases (the so-called pneumonic form of thyroid carcinoma metastasis in the lung).

Example 2. Patient B-ko. Diagnosis: papillary thyroid cancer pT2N1aMo, metastases in the cervical lymph nodes on the left, after surgical treatment, and radioiodine therapy. Metastases in the lung parenchyma. Stage I, second clinical group. Severe hypothyroidism.

From the anamnesis of the disease, it is known that in 2008, an ultrasound of the neck incidentally detected a node in the left region of the thyroid gland 14 x 8 mm. Cytologically after aspirational needle biopsy of this node, papillary thyroid carcinoma was confirmed. In this connection, on 10.02.2009, thyroidectomy was performed at the S.P. Hryhoriev Institute of Medical Radiology of the Academy of Medical Sciences of Ukraine. PGV No. 1855-72/09 – papillary thyroid carcinoma (pT2N1aMo). According to the planned program of treatment of this disease, on March 4, 2009, the patient received treatment at 2,923 MBq for therapeutic purposes. Scintigraphy of the residual activities of the 131I neck and thorax area revealed an outbreak of radiopharmaceutical agents fixation in the thyroid gland projection (Figure 4). To achieve the ablation of residual tissue, a second course of 131I radioiodine therapy with activity at 1,480 MBq was performed on 16.09.2009.

Upon scintigraphy on “residual” activities of 131I, the fixation of radiopharmaceutical agents at the typical site and parenchyma of both lungs were noted (Figure 5), i.e., Functionally active metastases of the thyroid gland in lungs were detected. In addition, this was confirmed by significantly increase thyroglobulin levels in the blood (494.2 ng/ml).

A Ct of the chest was performed to clarify the diagnosis and follow the protocol for the study of patients with cancer. In the study of a series of tomograms, only signs of chronic obstructive bronchitis were identified (in this case, negative X-ray metastases of the thyroid carcinoma were observed). Subsequently, the patient underwent suppressive hormone therapy and was recommended long-term radioiodine therapy.

## 4. CONCLUSIONS:

Thus, radioiodine therapy was effective in 52 (76.5%) patients, which allows continuing the use of radioiodine therapy for the treatment of patients with pulmonary metastases. In 12 people (17.6% of cases), the treatment was ineffective, the spread of metastatic lesions was observed during the entire period, in 4 cases (5.9%), there were metastases in the cervical lymph nodes.

Therefore, the analysis of the obtained data proved a relatively high efficacy of RIT in patients with thyroid carcinoma with metastatic lung injury – 28 patients (13.8% of cases) received a full therapeutic effect after 5 years of treatment, which even corresponds to the data reported in the literature. The obtained results indicate the need for further use of RIT, improvement of treatment methods (e.g., radical surgery with compulsory lymph node dissection), the use of recombinant human thyroid-stimulating hormone to prolong suppressive hormone therapy for the period of RIT, the use of differentiating therapy in the presence of partial or complete radioiodine-resistant “residual” thyroid tissue, metastatic lymph node lesions, lung metastases in patients.

In 5 years of treatment with patients with radioiodine in almost half of cases of metastatic

lung injury achieved full effect in 43.8% of cases, stabilization or partial effect – in 37.5% of cases. Full body scintigraphy for "residual" activities of $^{131}$I after the issuance of therapeutic activities $^{131}$I-sodium-iodide gives definitive information about the prevalence of the tumor process and in 26% of cases allows to detect pulmonary radiographies metastases after surgical treatment.

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***Table 1.*** *Distribution of patients by sex and age*

| | Abs. | % | Average | Median | Min | Max |
|---|---|---|---|---|---|---|
| All patients | 68 | 100 | 46.3±14.6 | 50.5 | 16.0 | 68.0 |
| Men | 17 | 26.5±5.6 | 42.4±15.8 | 45.0 | 16.0 | 67.0 |
| Women | 51 | 73.5±5.6 | 47.7±19.9 | 51.0 | 21.0 | 68.0 |

***Table 2.*** *Distribution of patients by type of surgery*

| Type of surgery | Number of patients | |
|---|---|---|
| | abs. | % |
| Single radical surgery | 25 | 32.8 |
| Non-radical surgery | 28 | 43.8 |
| Non-radical surgery + definitive thyroidectomy | 15 | 23.4 |
| Total | 68 | 100 |

***Table 3.*** *The presence of remote metastases of the thyroid gland, depending on the size of the primary tumor according to T data*

| Metastases | The size of the primary tumor of the thyroid gland by T | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | T1 | | T2 | | T3 | | T4 | | Tx | |
| | Abs. | % | Abs. | % | Abs. | % | Abs. | % | Abs. | % |
| M0 | 18 | 28.1 | 17 | 26.6 | - | - | 8 | 12.5 | 3 | 4.7 |
| M1 | - | - | 4 | - | 5 | 7.8 | 5 | 7.8 | 8 | 12.5 |
| Total | 18 | 28.1 | 21 | 26.6 | 5 | 7.8 | 13 | 20.3 | 11 | 17.2 |

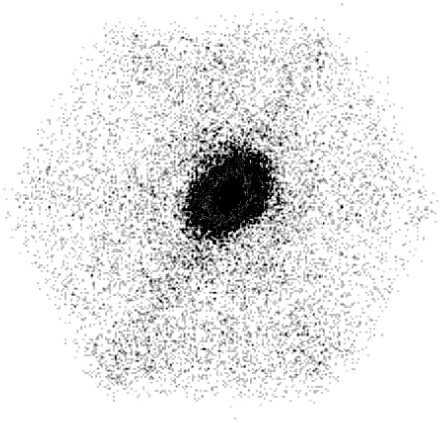

***Figure 1.*** *Scintigram of the neck and chest area in the forward direct projection on "residual" $^{131}I$ activity after receiving therapeutic $^{131}I$ activity*

***Figure 2.*** *Computed tomography of the chest*

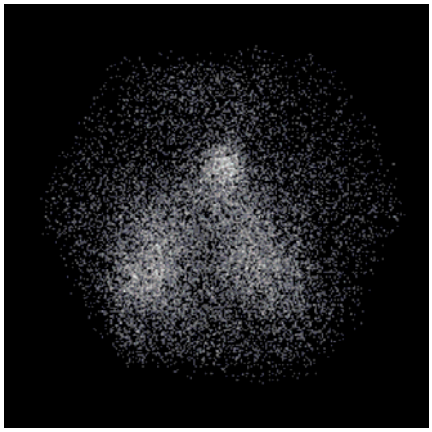

***Figure 3.*** *Scintigram of the neck and chest area in the forward direct projection on "residual" $^{131}I$ activity after receiving therapeutic $^{131}I$ activity*

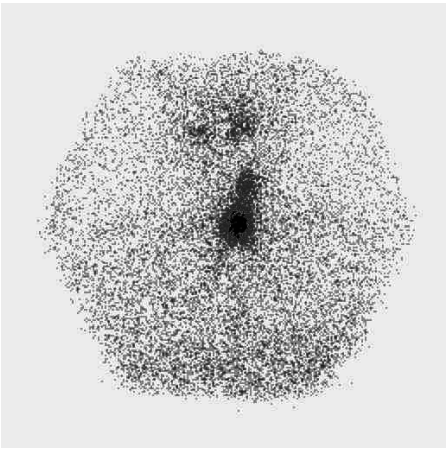

***Figure 4.*** *Scintigraphy of the neck and chest area on "residual" $^{131}I$ activity after radioiodine treatment activity*

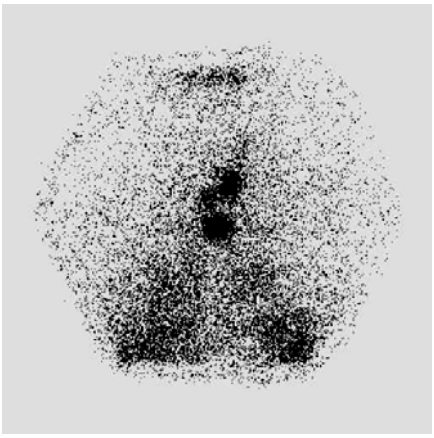

***Figure 5.*** *Scintigraphy of the neck and chest area on "residual" $^{131}I$ activity after radioiodine treatment activity*