UDC 616.441-006.6-085.849

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RADIATION-INDUCED MYELITIS AFTER RADIOIODINE THERAPY OF PAPILLARY THYROID CANCER: CLINICAL CASE

Abstract

Thyroid cancer incidence has been rising in most countries around the world in recent decades, and the most common form of thyroid cancer is papillary thyroid cancer. Application of radioiodine therapy for papillary thyroid cancer depends on the degree of postoperative risk of the disease recurrence. Radioactive iodine is recommended after radical thyroidectomy in case of intermediate or high risk of recurrence to reduce the probability of disease progression and to increase survival. The aim of radioiodine therapy is the ablation of thyroid tissue left after thyroidectomy and metastases, accumulating radioactive iodine. The recommended activity of the radiopharmaceutical is 30 mCi in the intermediate risk group and 30 to 150 mCi in a high risk group, but total doses and multiplicity of courses varies widely. The acute side effects of radioiodine therapy, the probability of which increases with a radioiodine dose of more than 100 mCi, include allergic reactions to iodine, radiation-induced parotitis and sialadenitis, gastritis, cystitis, pulmonitis (with lung metastases), myelodepression, transient amenorrhea and hypospermia. The listed violations are transient and last from several days to several months.
In the presented article the clinical case of papillary thyroid cancer with metastases in the neck lymph nodes was examined. The patient underwent thyroidectomy, central lymphadenectomy and radiotherapy. One year after the third course of radioiodine therapy the patient experienced the development of radiation-induced gastritis, myelodepression and myelitis, manifested by a severe pain syndrome in the cervical spine and sensory and motor disorders of hands and legs. Pulse therapy with glucocorticoids in combination with drugs that improve microcirculation, neuromuscular conduction and reduce the severity of neuropathic disorders allowed to manage radiation-induced complications.

Key words: *thyroid, papillary thyroid cancer, radioiodine therapy, radiation-induced complications*

For citation: Farkhutdinova L.M. RADIATION-INDUCED MYELITIS AFTER RADIOIODINE THERAPY OF PAPILLARY THYROID CANCER: CLINICAL CASE. The Russian Archives of Internal Medicine. 2018; 8(3): 223-230. [In Russian]. DOI: 10.20514/2226-6704-2018-8-3-223-230

DOI: 10.20514/2226-6704-2018-8-3-223-230

TgAb — Thyroglobulin autoantibodies, CT — computed tomography, RIT — radioiodine therapy, rhTSH — recombinant human TSH, WBS — whole body scintigraphy, Tg –thyroglobulin, TSH — thyroid-stimulating hormone, USS — ultrasound scan, CLND — central lymph node dissection

Thyroid cancer incidence has been rising in most countries around the world in recent decades. Over the course of 10 years this figure has almost doubled in the Russian Federation, affecting 6.1 persons per 100,000 residents. Each year about 8,000 primary cases are registered. However, thyroid cancer rarely is the cause of death, since in 90% of cases highly differentiated cancer (papillary, follicular) with a good clinical prognosis occurs, and the most common form of adenocarcinoma is papillary cancer (about 80%). Cells of highly differentiated thyroid adenocarcinomas can produce thyroglobulin (Tg), a specific protein of thyroid tissue, and concentrate iodine, the binding of which to the molecule of Tg ensures formation of thyroid hormones. This provides the basis for the use of the blood Tg level test for the monitoring of treatment effectiveness to detect residual tissue as well as to indicate when to apply radioiodine for diagnostic and therapeutic purposes [1–3, 10, 13].

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Principles of Treatment of Patients with Papillary Cancer

The extent of surgical intervention depends on the degree of risk of the disease. Hemithyroidectomy is thus considered to be an adequate operation for a tumor that is up to 4 cm in diameter without extrathyroidal extension, which is determined clinically or on the basis of the results of ultrasound scan examination (USS) and/or metastatic lymph nodes, a hereditary factor, and head and neck irradiation in past medical history. If the tumor size is more than 4 cm or there is a significant extrathyroidal extension, regional or distant metastases, thyroidectomy is performed with the maximum removal of tumor tissue. If metastases in central neck lymph nodes (anterior lymph nodes) are detected at the preoperative or intraoperative stage, a central neck lymph node dissection (CLND) is recommended. Advanced form of the disease (a tumor that is more than 4 cm in diameter within the thyroid tissue or that is any size with extrathyroidal extension) and preoperatively verified lateral neck nodal metastases are indications for preventive CLND.

The use of radioiodine therapy (RIT) for thyroid papillary cancer treatment is determined by the degree of postoperative risk of disease recurrence, which is classified according to the American Thyroid Association Guidelines 2009 as amended in 2015 [2, 7, 8, 12].

The following cases are classified in the ***group that is at low risk*** of papillary cancer recurrence*:

- If macroscopically all tumor tissue is removed, locoregional and distant metastases, extrathyroidal extension and vascular invasion are absent, and the first ^{131}I whole body scintigraphy (WBS) does not detect metastatic foci, the histological variant is nonaggressive.
- Metastases to regional lymph nodes are absent (cN0, c — clinical classification) or no more than five lymph nodes are affected (pN1, p — pathological classification), and the metastases do not exceed 0.2 cm in the largest dimension (micrometastases).
- The intrathyroidal papillary microcarcinoma (unifocal or multifocal); in these cases BRAFV600E** mutations are considered to be prognostically insignificant.

The ***intermediate risk group*** includes:

- Intrathyroidal papillary cancer that is less than 4 cm in diameter with a BRAFV600E mutation.
- Metastases of more than 5 lymph nodes (cN1 or pN1), and up to 3 cm in the largest dimension (macrometastases).
- Microscopic extrathyroidal extension.
- Papillary cancer with vascular invasion.
- Multifocal papillary microcarcinoma with microscopic extrathyroidal extension and BRAFV600E mutation.
- Metastatic foci in the neck, accumulating radioactive iodine according to data of the first ^{131}I WBS.

The following cases of papillary cancer recurrence are classified in the ***high risk group***:

- Residual tumor.
- A tumor in combination with a TERT***±BRAF mutation.
- Metastases of lymph nodes pN1 with any metastatic node more than 3 cm in the largest dimension.
- Macroscopic extrathyroidal extension.
- Proven distant metastases.
- High concentration of Tg, which is characteristic of distant metastases.

Radioactive iodine is used when there is an intermediate or high risk of thyroid cancer recurrence after radical thyroidectomy, which reduces the probability of disease progression and increases survival rate. At low risk, RIT is not appropriate, as it does not affect the mortality rate in this group of patients. The aim of RIT is the ablation of thyroid tissue left after thyroidectomy and metastases, which accumulate radioactive iodine. The first course of RIT is performed 3–6 weeks after thyroidectomy. If initially an organ-preserving operation was performed on the thyroid, classification of the patient in the group of intermediate or high risk of recurrence is an indication for radical thyroidectomy.

* This article proposes a classification that is specific to papillary thyroid cancer only.

** The BRAF gene mutation is associated with multifocal tumor growth, lymph node metastasis, and recurrence development. Therefore, it is considered as a marker of risk stratification.

*** The mutation of the TERT gene, which codes telomerase activity, determines the ability of unrestricted cell division.

The effectiveness of radioiodine ablation depends on the activity of ^{131}I absorption by thyroid cells, which in turn are determined by the level of thyroid stimulating hormone (TSH). It is recommended to carry out RIT before prescribing levothyroxine. In addition, the patient should follow a diet low in iodine over the course of 3–4 weeks before the RIT procedure. If patients are taking levothyroxine, then they should stop taking this medicine 4 weeks before RIT. The alternative is administration of recombinant human TSH (rhTSH)**, which makes it possible to examine and treat a patient using radioiodine without canceling levothyroxine sodium. The target level of TSH is considered to be more than 30 mIU/l. However, the optimal concentration of this hormone has not been determined.

To assess the accumulation of the radiopharmaceutical, ^{131}I WBS is performed at a dose ranging from 2–5 (to locate the residual tissue after thyroidectomy) to 10 mCi (to detect distant metastases). RIT is carried out in case of radiopharmaceutical high absorption using 30 mCi for patients in the intermediate risk group and from 30 to 150 mCi for patients in the high risk group. Distant metastases to the lungs respond to radioiodine treatment, although as metastatic foci increase in size the effectiveness of RIT is reduced.

Patient monitoring in dynamics is aimed at early detection of recurrence or progression of the disease (metastasis). Two to three months after initial treatment the thyroid status (TSH, free fractions of thyroxine and triiodothyronine) is analyzed to assess the adequacy of replacement therapy with levothyroxine sodium. To confirm remission, a conventional examination, USS, computed tomography (CT) at indications, WBS, stimulated Tg test*** (levothyroxine withdrawal 4 weeks before the analysis or administration of rhTSH) and antibodies to thyroglobulin (TgAb) are carried out after 6–12 months.

Postoperative management of the patient involves constant monitoring of the patient's current risk category. Four main groups are identified according to treatment results.

I. Biochemical remission:
- ✓ USS, WBS, CT do not reveal pathological foci.
- ✓ Unstimulated Tg: less than 0.2 ng/ml.
- ✓ Stimulated Tg: less than 1.0 ng/ml.

For this group of patients the probability of recurrence is 1–4%.

II. Biochemical recurrence:
- ✓ USS, WBS, CT do not reveal pathological foci.
- ✓ Unstimulated Tg: more than 1.0 ng/ml.
- ✓ Stimulated Tg: more than 10 ng/ml.
- ✓ Increase of antibodies to Tg (TgAb).

In approximately 30% of cases biochemical indicators spontaneously decrease for the patients in this group, in 20% of cases there is remission after additional RIT is observed, and in 20% of cases a structural recurrence is observed. In this regard maintenance of stable concentration of Tg or its decrease allows, in most cases, to limit the procedure to monitoring. When Tg or TgAb increase, an active examination and additional RIT are recommended. The mortality rate of thyroid cancer does not exceed 1%.

III. An unidentified tumor status:
- ✓ USS, WBS, CT do not reveal pathological foci or the results are nonspecific.
- ✓ Unstimulated Tg: from 0.2 to 1.0 ng/ml.
- ✓ Stimulated Tg: from 1.0 to 10 ng/ml.
- ✓ The TgAb titer is stable or decreases.

The probability of structural recurrence in this group is slightly lower than in the previous group: 15–20% (nonspecific changes can be stable or disappear). In most cases, examinations (visualization, Tg) and biopsy of suspicious changes are carried out. The mortality rate of thyroid cancer does not exceed 1%.

IV. Structural recurrence:
- ✓ Structural or functional signs of the tumor at any level of Tg or TgAb.

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* The medication rhTSH has been in use since 2005 in EU member countries and since 2007 in the USA. In Russia, the medication rhTSH is not covered by the patient management guidelines for differentiated thyroid cancer treatment. Therefore, if necessary, patients must purchase it independently at their own expense. The cost is about 1,200 euros.

** Highly sensitive methods for determining blood Tg (< 0.1 ng/ml) are considered an alternative to carrying out stimulating tests.

Approximately 50–60% of patients in this group have a persistent tumor, despite additional treatment. Mortality rate from thyroid cancer with regional metastases reaches 11%, and it reaches 50% when there are distant metastases.

The degree of risk of the disease determines the choice of treatment regimen with thyroid hormones:

- ✓ Replacement therapy aimed at correction of hypothyroidism. The target TSH level is 0.5–2.0 mIU/l.
- ✓ Suppressive therapy, inhibiting TSH-dependent growth of residual tumor cells, and TSH less than 0.1 mIU/l; free thyroxine does not exceed the upper limit of the norm.
- ✓ Mild suppression. TSH is within the range of 0.1–0.5 mIU/l.

Suppressive therapy is performed in a group of high-risk and structural recurrence (with the exception of patients with atrial fibrillation for whom mild suppression is recommended). In addition, in the intermediate risk group there are biochemical recurrence and an unidentified tumor status (except for cases of tachycardia and a menopause period when mild suppression is recommended, along with patients over 60 years old, patients with atrial fibrillation and osteoporosis, for whom replacement therapy is recommended).

The determination of Tg is considered to be the most sensitive method of dynamic observation, since this parameter is a specific marker of thyrocytes and cells of highly differentiated thyroid cancer (papillary and follicular). To carry out this study, methods with a sensitivity of at least 0.2 ng/ml were used. It is necessary to consider that the presence of TgAb in blood can produce a false negative result when the Tg determination method is used. However, Tg can be detected within a few months after the initial treatment. Therefore, it is not advisable to perform the test within the first three months after the last treatment stage.

Postoperative examination of Tg and TgAb during levothyroxine therapy is recommended every 6–12 months. For the high risk group the intervals may be shorter, and for those in biochemical remission it can be longer: from 12 to 24 months. Re-testing of stimulated Tg is carried out for the high risk, structural and biochemical recurrence, and unidentified status groups, while for the low risk and biochemical remission groups repeated Tg testing is not recommended. The level of TSH should be estimated at least once every 12 months. Performing of neck USS is recommended after 6–12 months, depending on the risk group and the results of Tg testing. If suspicious lymph nodes are detected with a maximum size of more than 0.8–1.0 cm, targeted fine-needle aspiration biopsy (FNAB) and Tg measurement in needle washout fluid are recommended. If the node is smaller, dynamic monitoring is allowable. A CT scan is justified in case of doubtful results of USS in relation to the spreading of disease, suspicion of extension in neck structures, as well as to reveal metastases to the lungs and mediastinal lymph nodes in the high risk group with elevated levels of Tg (usually more than 10 ng/ml) or increased TgAb, regardless of the WBS data. Abdominal CT or MRI, MRI of the brain and skeleton are recommended for the group of high risk patients with elevated Tg concentrations (as a rule, more than 10 ng/ml) in the presence of signs of metastatic affection of these organs as well as in the absence of metastases to the lungs, lymph nodes of the neck and mediastinum [2].

The majority of the recurrences occur within the first three years of diagnosis, while local recurrences and regional metastases do not worsen the prognosis. In rare cases, a recurrence may develop after 20 years.

According to A. R. Shaha, the survival rate for highly differentiated thyroid cancer in the low risk group is 99%; for the intermediate risk group it is 87%, and for the high risk one it is 57% [5, 6, 11, 14, 15].

Complications of Radioiodine Therapy

For both treatment and for diagnosis, radioactive ^{131}I with a half-life of 8.05 days is used. The penetrating power of β-particles, constituting 90% of the radiation, does not exceed 2.2 mm, thus avoiding damage to surrounding tissues.

The recommended activity of the medicine for radioablation amounts, as noted above, in the intermediate risk group 30 mCi, and in the high risk group it varies from 30 to 150 mCi, while the total

doses and the multiplicity of courses vary widely. The acute side effects of radioiodine therapy, the risk of which increases with a radioiodine dose of more than 100 mCi, include allergic reactions to iodine, post-radiation parotitis and sialadenitis, gastritis, cystitis, pulmonitis (with lung metastases), myelodepression, transient amenorrhea and hypospermia. The listed disorders are transient and last between several days and several months.

The long-term consequences of radioiodine application are cancers of other localizations, the risk of which increases when doses exceed 600–700 mCi [4].

The authors have not found information about the chance of developing myelitis as a result of radioiodine therapy in the available literature. In this connection, we present our own observation.

Clinical Case

On October 13, 2016, a 26-year-old patient was admitted to the Department of Neurology of G. G. Kuvatov Republican Clinical Hospital (RCH), Ufa. Complaints on admission: numbness in hands and feet, a decrease in sensitivity in hands, weakness in limbs, difficulty in fine motor skills, periodic pain in hands, feet and cervical spine, and pain in lumbar spine and legs when the head is tilted. Neurological examination diagnosed upper peripheral light distal paraparesis, lower limb pyramidal tract dysfunction, and distal paresthesia. The patient noted that his health deteriorated over the course of two months: at first there was intense pain in the cervical spine, then numbness, tingling, and weakness in the limbs. It became difficult for the patient to hold instruments (he works as a locksmith) and to write. He had difficulty walking, and subsequently numbness spread to the whole body.

According to the results of cervical spine MRI on October 5, 2016, a pathological zone of 1.8 cm in length intramedullary at the level of the Th1 vertebra was revealed, which was interpreted as a probable manifestation of transverse myelitis. The patient was urgently admitted to the Department of Neurology of the Central City Hospital (Uchaly), where he received pulse therapy (Metypred 1,000 mg three times for 1 week). During treatment, the severity of pain and weakness in the limbs decreased, after which the patient was transferred to the Neurological Department in Ufa.

The medical history: 5 years ago, in January 2012, during the preventive examination, thyroid cancer was found on the right. According to USS data, a focal mass that was 3 cm in diameter in the lower pole of the thyroid right lobe had exhibited changes that raised suspicions that it might be cancer: fuzzy uneven contours and increased intranodular blood flow. Papillary cancer, T3N0M0, was diagnosed on the basis of the results of FNAB. In February 2012, thyroidectomy was performed. Histological examination of the right lobe — papillary carcinoma with invasion of the thyroid capsule into half of its thickness, left lobe — macrofollicular nodular goiter in connection with autoimmune thyroiditis. Recommended observation by an endocrine surgeon, taking levothyroxine 100 μg/day, and a TSG test in 2 months. However, the patient for family reasons arrived for his control examination 14 months later, in April 2013. A focal mass that was 9 mm in diameter was revealed in a bed of the left thyroid lobe and bilateral increase of regional lymph nodes. The tumor of the left lobe was removed. Histological conclusion: toxic nodular goiter, reactive sinus histiocytosis. It was recommended to consult a radiologist to decide if RIT was necessary.

Re-examination after 3 months, in July 2013, did not detect pathological changes according to the USS of the thyroid, but the level of Tg was high: 81.4 ng/ml, and therefore on July 12, 2013, a course of RIT (81 mCi) was carried out and the dose of levothyroxine was increased to 275 μg/day. Whole body scintigraphy after 3 days revealed an increased accumulation of the radiopharmaceutical in the projection of the removed thyroid gland (10.2% of WBS), which along with a high concentration of Tg was the cause for planning the second course of radioiodine therapy after 6 months.

According to the results of the examination in February 2014, Tg was 66.87 ng/ml, and TgAb was less than 20 IU/ml (on levothyroxine withdrawal). The USS of the neck showed no pathology in the projection of the removed thyroid gland; however, in the region of the neck to the right in the middle third along the course of the vascular bundle, two

hypoechoic nodes, 14×7 and 9×7 mm, were visualized. Ultrasound-guided cervical node puncture was performed on the right. Cytological examination revealed a group of cells more similar to papillary thyroid cancer among lymphoid cells. The 2nd course of RIT (81 mCi) was carried out. Three days after treatment WBS showed the focus of increased accumulation of the radiopharmaceutical in the projection of the neck: 2.8% of WBS, and thyroid scintigraphy — the focus of increased accumulation in the projection of the neck lymph nodes, which, taking into account the results of USS, indicated metastasis to neck lymph nodes.
In the same month, the patient underwent an operation: CLND (levels I–V) on the right. Histological study confirmed metastases of thyroid papillary carcinoma in the lymph nodes (levels IIa–IV) with focal ingrowth in the capsule of lymph nodes, without proliferation into the surrounding soft tissues. The dose of levothyroxine was recommended to be increased to 300 μg per day.

After 3 months, in May 2014, the following was determined according to the results of the thyroid ultrasound examination: state after thyroidectomy on the left and resection of the right lobe and isthmus, the right part measuring 14×18×44 mm, 5.3 cm^3, left — 7×7×21 mm, 0.5 cm^3, total volume — 5.8 cm^3. Abdominal USS, chest X-ray also showed no pathology. In August 2014, the Tg level was 0.75 ng/ml, and the TgAb was less than 0.9 IU/ml (after levothyroxine withdrawal). In the same month, the 3rd course of RIT (81 mCi) was carried out. The examination, which was carried out 3 days later, revealed 2 foci of hyperfixation of the radiopharmaceutical in the neck region: 4% of WBS. The result of the neck USS: state after thyroidectomy.

In July 2015, thyroid USS did not visualize the left lobe and isthmus, there were no additional formations in their projection, and in the projection of the right lobe the following partially survived glandular tissue was determined: 13×7×26 mm, a volume of 1.2 cm^3, of heterogeneous structure due to two hypoechoic avascular formations in the lower pole up to 2.3 mm in diameter with clear, even contours. Chest X-ray and abdominal ultrasound did not reveal pathology. Tg was 0.29 ng/ml, and TgAb was less than 0.9 IU/ml (after levothyroxine withdrawal).

In August 2015, WBS and thyroid scintigraphy did not reveal hyperfixation foci of the radiopharmaceutical. Considering the low level of Tg and TgAb, the absence of pathological accumulation of the radiopharmaceutical according to scintigraphy data, remission of the disease was diagnosed. It is recommended to continue levothyroxine intake in the maximum tolerated dose as well as neck USS and unstimulated Tg measurements once every 6–9 months, chest X-ray and abdominal ultrasound once a year, and oncologist and endocrinologist follow-ups at the place of residence.

Starting in the autumn 2015, a year after the third course of radioiodine, the patient experienced periodic abdominal pain and weakness. According to the results of a clinical blood test, there was a fluctuating decrease in leukocytes, platelets, erythrocytes and hemoglobin, as well as relative lymphocytosis with neutropenia. To treat these symptoms, the patient received iron supplements, vitamin B12, and folic acid. However, the epigastric pain syndrome and weakness progressed. In June 2016, according to the examination data, pancytopenia in peripheral blood was detected: leukocytes were 1.5×10^9/l ($4.04–5.90\times10^9$/l, here and below, the reference interval is indicated in parentheses), platelets — 80×10^9/l ($142–424\times10^9$), erythrocytes — 2.24×10^{12}/l ($4.04–5.90\times10^{12}$), and hemoglobin — 68 g/l (120–170). In the leukogram an increase in the relative number of lymphocytes to 57% (19.0–37.0) along with the reduction in the number of segmented neutrophils to 37% (47–72) were observed. A biochemical analysis of the blood detected the cytolysis phenomena: an increase in the activity of creatine phosphokinase up to 417 IU/l (up to 190) and aspartate aminotransferase to 47 IU/l (5.0–38.0). Fibrogastroduodenoscopy revealed hemorrhagic gastritis, and the abdominal MRI noted an increased spleen to 139×64 mm.

The patient was admitted to a hospital, where he received treatment, including blood transfusions, proton pump blockers, gastric cytoprotectors, and enzyme supplements. As a result, the state of health was normalized, and blood parameters reached reference values. However, 2 weeks after discharge, neurological complaints, which were discussed above, appeared requiring emergency admission to

the clinic at the place of residence, Metypred pulse therapy administration and subsequent transfer to a specialized department in Ufa.
At the Department of Neurology of G. G. Kuvatov RCH, a differential diagnosis between paraneoplastic spinal cord injury, dysmetabolic changes in the nervous system and neurological pathology of inflammatory genesis was performed.

According to the results of clinical blood test, transient thrombocytopenia and relative lymphocytosis were identified. On October 14, 2016, the number of platelets was thus 80×10^9/l ($142–424\times10^9$), and 43% (19.0–37.0) were lymphocytes (in the leukogram). After 10 days, on October 25, 2016, platelets and lymphocytes were within the normal range: 241×10^9/l and 27%, respectively.

Sternal puncture data revealed bone marrow hypocellularity (the number of myelokaryocytes was 34×10^9/l [$50.0–150\times10^9$]) and an increase in the relative number of lymphocytes (17.3% [4.3–13.7]). According to the results of immunophenotyping of bone marrow cells, an increase in the relative amount of B-lymphocytes ($CD3^-$, $CD19^+$) up to 25% (7–17) and T-cytotoxic cells ($CD3^-$, $CD19^+$) up to 40% (19–35) was registered. Examination of cerebrospinal fluid revealed no pathological abnormalities.
Thyroid indicators corresponded to euthyroid status: TSH — 0.86 mIU/ml (0.23–3.4), T4 — 22.6 pmol/l (10.0–23.2). The low level of Tg — 0.07 ng/ml (1.4–74.0) along with the absence of pathological changes in thyroid USS and chest X-ray confirmed the remission of cancer. According to the results of abdominal USS, the size of the spleen was normalized (121×60 mm).
Stimulation electroneuromyography determined signs of dysfunction of conduction along the C6–C8, L5–S1 nerve roots and moderate myelopathy of the sensory fibers of the median and ulnar nerves on the left. MRI data from October 24, 2016, compared with data from October 5, 2016, reflected a positive course of improvement: the signal intensity in the myelopathic focal area decreased.
Based on the results of the examination, the paraneoplastic genesis of changes in the nervous system was excluded on the basis of remission of cancer. Dysmetabolic cause of the disease was also rejected because of the absence of risk factors (alcohol abuse, toxic substance abuse, etc.).

In addition, the gradual appearance and progression of the neurological symptoms, the reversal of most of the symptoms due to Metypred pulse therapy, including the positive developments according to MRI results, mostly corresponded to the inflammatory nature of the pathological process, apparently of an immune nature, associated with irradiation.

The activation of the immune system is indicated by relative lymphocytosis in the peripheral blood, an increased level of B-lymphocytes and cytotoxic cells according to immunophenotyping of bone marrow cells, and also a splenomegaly. Preemptive damage to the cervical spine is apparently due to its anatomical closeness to the thyroid gland, in the residual tissue of which the radioiodine concentrates. The probability of radiation-induced myelitis is also confirmed by a relatively high cumulative dose of radiation received by the patient: more than 200 mCi.

As is known, radiation exposure mechanism works on the basis of oxidative stress with the formation of a large number of chemically aggressive radicals that damage cells. Unlike high doses of radiation that cause massive cell death with the development of radiation sickness, the average doses cause the activation of autoimmune reactions, which in the present case is confirmed by the contingency of the revealed disorders with the activation of the lymphocytic segment of immune system and the effect of glucocorticoid therapy [9].

The diagnosis was formulated at the Department of Neurology of G. G. Kuvatov RCH as follows: Polyneuropathy secondary to somatic disorder (thyroid nodular goiter, state after surgical treatment and repeated courses of RIT, fluctuating reactive pancytopenia), upper peripheral light distal paraparesis, lower limb pyramidal tract dysfunction, and distal paresthesia. The treatment was aimed at improving microcirculation (pentoxifylline) and neuromuscular conduction (proserin) as well as at reducing the severity of neuropathic disorders (carbamazepine, amitriptyline, magnet therapy of the collar zone).

The patient was discharged with significant improvement. Follow-up examinations in 2016–2017 did not reveal pathological abnormalities.

In the presented case, radiotherapy was thus accompanied by the development of acute radiation-induced complications: gastritis, myelodepression, and myelitis. The predominant damage to the gastric mucosa is associated with oral administration of the medicine. Manifested disorders of blood system attributed to high sensitivity of blood cells to ionizing radiation and the revealed transient changes in the hemogram are explained by the lifespan of these cells and the periodic restoration of their number in the peripheral blood due to the formation of immature blood cells. The development of myelitis of the cervical region is apparently due to its anatomical proximity to the thyroid gland, and the possibility of this complication should be taken into account when performing radioiodine therapy for papillary cancer.

Conflict of interests

The authors declare no conflict of interests.

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Article received on 19.03.2018
Accepted for publication on 07.05.2018