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DOI 10.70286/ISU-19.11.2025.007

EFFECTS OF IODINE- BASED CONTRAST MEDIA ON THYROID FUNCTION

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Abstract.

Relevance. In modern medicine, for the purpose of diagnostic imaging, research methods related to contrast are widely used, primarily with the use of iodine-based contrast media (ICM), in particular, coronary angiography (CA), computed tomography (CT). Unfortunately, in a certain range of patients, performing this type of study is closely associated with subsequent thyroid dysfunction.

Purpose. Conduct a systematic review of the literature on disorders of the thyroid gland, in particular, thyrotoxicosis caused by the introduction of ICM during CA, CT. Determine the control points of thyroid function in patients subjected to CA, CT with the use of ICM. Investigate the influence of gender, age and initial condition of the thyroid on the risk of contrast-induced disorders on the part of the thyroid and evaluate the effectiveness of measures to overcome them.

Materials and methods. Using the method of analysis of literature data, to assess the frequency of thyroid dysfunction in adult patients and the presence of favorable risk factors in original studies for the period from 2000 to 2025.

Results: In the studies included in the analysis, the incidence of subclinical or manifest thyrotoxicosis ranged from 1% to 15%, depending on the status of the iodine

supply and the presence of background thyroid disease. Risk factors were advanced age, previous iodine deficiency (and/or living in iodine deficiency regions), multinodular goiter, and low level of TSH before CA, CT. Prophylactic use of thyrostatics has been effective in certain patients from the risk groups.

Conclusions. CA using ICM can lead to impaired thyroid function in predisposed individuals. Given that most of Ukraine's territory is in the iodine-deficiency zone, a general screening examination may be appropriate and is especially justified for vulnerable groups.

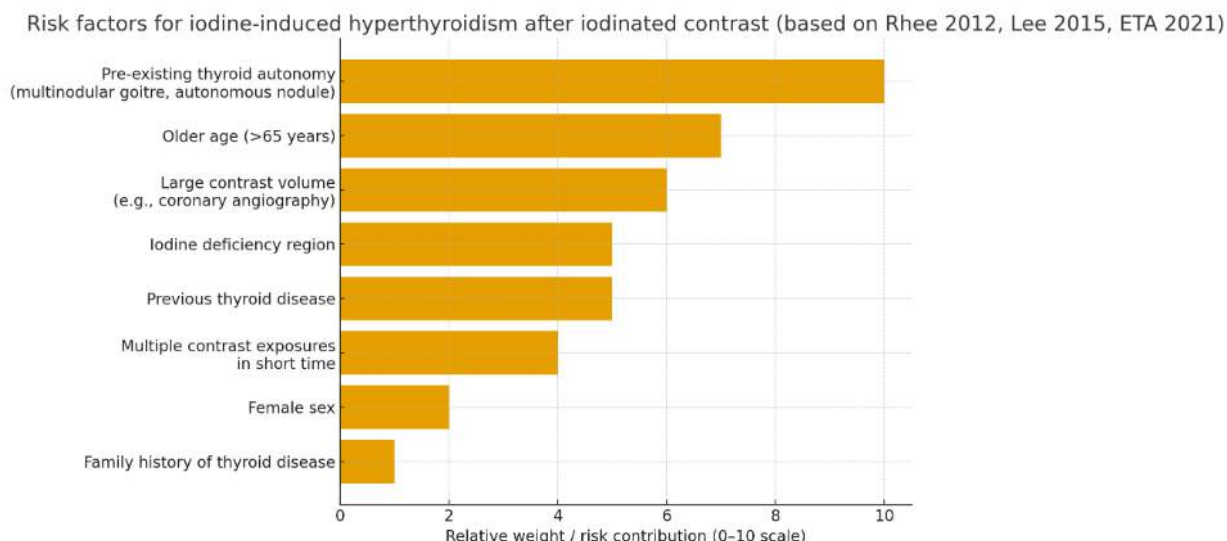
Key words: iodine-based contrast media, coronary angiography, iodine-induced hyperthyroidism risk factors.

Introduction. Iodine-based contrast media (ICM) are an integral part of modern medical imaging, but their administration can cause excessive intake of iodine, which, in turn, leads to disorders of the thyroid gland function, most often in the form of iodine-induced thyrotoxicosis (IT).

In general, approximately 150 mcg of iodine is required for the synthesis of thyroid hormones every day. In iodine-deficient countries worldwide, including Ukraine, 17 regions of which suffer from severe and moderate iodine deficiency, the population often lacks sufficient iodine in its diet, which, in turn, leads to euthyroid hyperplasia of the thyroid gland (euthyroid iodine-deficient goiter). In such a situation, the sudden effect of an excess of iodine during the introduction of ICM becomes the basis for the synthesis of thyroid hormones (T3, T4) – iodine-induced hyperthyroidism (or Jod-Basedow effect). This is especially relevant for elderly patients with certain concomitant conditions: with coronary heart disease (CHD), arterial hypertension (AH), diabetes mellitus (DM), etc., taking into account possible serious complications.

Materials and methods. Using the method of analysis of literature data, assess the frequency of thyroid dysfunction in adult patients and the presence of favorable risk factors in the original studies for the period from 2010 to 2025. In the Python environment, using the Matplotlib library, we will form a diagram using the horizontal bar chart method that will reflect the strength of each factor's influence on the risk of developing IT. The analysis included prospective or retrospective studies involving individuals undergoing CA or CT using ICM. The analysis did not include studies in the pediatric population, in animal models and isolated clinical cases.

Results. In the course of the analysis, IT should primarily be expected in patients with thyroid autonomy (autonomous node, toxic multinodular goiter), the elderly (over 65 years old), patients who receive large amounts of contrast (for example, during coronary angiography) in people from iodine-deficient regions, patients with previous diseases of the thyroid and those who have undergone several contrast examinations in a short time while the female sex and family history of thyroid diseases affect IT much less than the above factors (Fig. 1.)



With this in mind, it is possible to note the impracticality of routine screening in all patients who are planned to be administered ICM, however, the above-mentioned groups of patients, especially under the conditions of a combination of several risk factors (for example, age, gender, burdened history and/or the presence of autonomy of the thyroid gland, etc.) should be at least measured by TSH and free T4 before planned contrast administration, and undergo consultation with an endocrinologist in the presence of abnormalities. As for the prevention of IT, it should also be considered in high-risk patients (confirmed autonomy, inability to avoid contrast) after consultation with an endocrinologist, usually it consists in the short-term appointment of thionamides (methimazole, carbimazole).

Most often, IT develops within 2 to 12 weeks after the procedure. Therefore, it is advisable for high-risk patients to monitor after administration of ICM: control of TSH and free T4 after 4 - 6 weeks, followed by a repetition of their determination in 8 - 12 weeks or when symptoms appear. In low-risk patients (age, burdened family history), determination of TSH and free T4 appropriate only in the presence of symptoms (tachycardia, tremor, weight loss, appearance of atrial fibrillation). In cardiac patients and especially in the event of cardiovascular complications, it is advisable to continue clinical observation longer than 3 months (the generally recommended term).

Treatment of confirmed IT depends on the course of the pathology. Patients with mild subclinical forms need observation, hormone control under the supervision of an endocrinologist. With clinically expressed IT, it is considered appropriate to prescribe antithyroid drugs (methimazole - the drug of choice) to control the symptoms of non-selective beta-blockers (propranolol), with a severe course or thyrotoxic crisis - intensive therapy. It should be remembered that in cardiac patients, even subclinical thyrotoxicosis can provoke arrhythmia or ischemia, so the threshold is lower for the treatment of this category of patients. Considering that frequent administration of ICM or administration of ICM in large volumes is an independent risk factor for IT. When carrying out procedures, it is necessary to minimize the volume of ICM and avoid frequent repeated procedures. In the referral of patients, existing risk factors should be specified in order to ensure proper control.

Discussion. The review confirms that the administration of an ICM may affect the function of the thyroid in individuals with hidden disorders or risk factors. This is most commonly the case in older adults with multinodular goiter, latent hyperthyroidism, or those living in regions with low iodine intake.

Most changes in thyroid function were transient and subclinical, clinical thyrotoxicosis occurred rarely, more often in patients with nodal changes. Although routine screening of all patients before CA is determined to be inappropriate, vulnerable groups should be assessed for TSH levels, scintigraphy (which helps to effectively stratify patients by risk), or prophylactic treatment should be prescribed. It is also worth considering that impaired thyroid function often occurs with a delay of several weeks after the introduction of contrast - therefore, it is important to organize proper observation for at least 3 months. The use of thyrostatic drugs (thiamazole, potassium perchlorate) in risk groups reduced the frequency of complications. It should also be noted that the studies discussed had certain shortcomings, namely: small samples, rather different methodology, and a lack of long-term follow-up.

Conclusions. Coronary angiography using an iodine-based contrast media may cause thyrotoxicosis in patients with latent or manifest thyroid disease. The overall risk of such complications is low, but the clinical consequences can be serious. Random testing, risk stratification, and preventive measures are justified in individual cases.

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