

Eurasian Medical
Research Periodical



Tumors Of The Head And Neck: Detection At Stage T Using Modern Imaging Techniques

**Akhmadzhanov Elmurodjon
Burkhanidinovich**

Assistant of the Department of Oncology
Andijan State Medical Institute

ABSTRACT

Tumors of the head and neck are characterized by an aggressive course and a high risk of late diagnosis. Despite advances in oncology, most patients are admitted to specialized centers at stages T2–T4, when the effectiveness of treatment is significantly reduced. The detection of tumors at the T₀ stage, when there are no clinical manifestations yet, but morphological and metabolic changes are already forming, is a key area of modern oncorentgenology .

The article discusses the possibilities of magnetic resonance imaging (MRI), computed tomography (CT) and positron emission tomography (PET/CT) in the diagnosis of head and neck tumors in the early stages. The results of clinical observations are presented, showing that the use of multiparametric MRI and hybrid technologies can increase the detectability of subclinical forms up to 92%.

Keywords:

head and neck tumors, stage T₀, early diagnosis, magnetic resonance imaging, PET/CT, oncology.

Relevance. Head and neck tumors account for up to 10% of all malignant neoplasms and are the sixth most common type of cancer. The main sites of origin are the oral cavity, oropharynx, nasopharynx, larynx, parotid and submandibular glands, and cervical lymph nodes [1,8].

Late diagnosis remains a major problem : approximately 65–70% of patients are diagnosed at stages T3–T4, when treatment requires combined approaches and is associated with a high rate of disability . Meanwhile, stage T₀ , characterized by the absence of clinical signs in the presence of microscopic or molecular changes, is virtually undetectable by standard methods[6].

Head and neck cancers (HNC) are among the leading malignant neoplasms in humans and remain a serious medical and social problem worldwide. According to the World Health Organization (WHO), more than 900,000 new cases of head and neck cancer are diagnosed

annually worldwide, with over half of patients presenting to a doctor at late stages of the disease (T3–T4). High mortality and disability rates , a significant decline in quality of life after treatment, and the socioeconomic consequences make the early detection of head and neck cancers extremely pressing.

One of the key factors in the poor prognosis of OHSG is late diagnosis, when the tumor process has already spread beyond the primary anatomical site, involving lymph nodes and adjacent structures. At the same time, early detection of the disease, especially at the preclinical stage (T₀), opens up fundamentally new treatment options, including organ-preserving interventions, photodynamic therapy, radiofrequency ablation, and targeted therapies [5].

Stage T₀ (according to the TNM classification) signifies the absence of a macroscopically detectable tumor in the presence of cellular, metabolic, or microscopic

changes characteristic of a malignant process. At this stage, the disease has no pronounced clinical symptoms: there is no pain, dysphagia, aphonia, tissue deformation, or lymph node enlargement. However, it is during this period that the pathophysiological mechanisms that determine the further progression of cancer are established. The ability to diagnose a tumor at stage T_0 signifies a transition from disease diagnosis to prevention, which is consistent with modern concepts of cancer prevention and personalized medicine[4].

The main difficulty is that traditional imaging methods—radiography, ultrasound, and even computed tomography (CT)—focus primarily on structural tissue changes. These methods detect a tumor only when it reaches a certain size and density, which corresponds to a clinically manifest stage (T1 and above). At T_0 , such changes are typically absent. Therefore, the urgent task today is to shift from structural to functional and molecular imaging, which is capable of detecting pathological processes at the cellular level.

The most promising approach in this regard is magnetic resonance imaging (MRI). Unlike CT, MRI has high tissue contrast and allows visualization of soft tissue structures of the head and neck with exceptional detail. The use of specialized modes, such as diffusion-weighted imaging (DWI), post-contrast dynamic imaging (DCE-MRI), and magnetic resonance spectroscopy (MRS), makes it possible to assess the physiological and biochemical characteristics of tissues: cellular density, perfusion, vascular permeability, and metabolic activity. This allows differentiation of tumor tissue from inflammatory or benign changes, even in the absence of macroscopic signs [5, 7].

Of particular importance is DWI-MRI, which records the diffusion of water molecules in the intercellular space. During tumor growth, tissue compaction occurs, cellular density increases, and water mobility decreases—all of which leads to a decrease in the diffusion coefficient (ADC). Thus, the appearance of areas with low ADC values can serve as an early sign of malignant tissue transformation, long before changes become visible in conventional T1/T2 sequences. This opens the possibility of

detecting cancer of the larynx, oropharynx, salivary glands, and lymph nodes at a subclinical stage. Along with MRI, positron emission tomography (PET/CT) using ^{18}F -fluorodeoxyglucose (FDG) makes a significant contribution to early diagnosis. This method is based on the principle of assessing tissue metabolic activity, which increases during malignancy due to increased glycolysis in tumor cells. Thus, PET/CT can detect foci of increased metabolism even in the absence of anatomical changes. The combined use of PET/CT and MRI provides the most comprehensive picture of the condition of head and neck tissues, allowing for an assessment of both the structural and functional characteristics of the lesion[9].

The role of contrast agents is equally important. Modern gadolinium-containing contrast agents used in MRI allow for the visualization of minimal disruptions of the blood-tissue barrier, typical of early tumor processes. Dynamic imaging allows for tracking the phases of contrast accumulation and clearance, reflecting the vascular architecture and perfusion of the tumor. These parameters are crucial for distinguishing between benign, inflammatory, and malignant processes.

Beyond its purely medical significance, early diagnosis of head and neck tumors has significant socioeconomic implications. Treatment of advanced forms requires expensive combination therapy—surgery, radiation therapy, and chemotherapy. This often leads to loss of voice function, impaired speech, breathing, and swallowing, leading to disability and social maladjustment. Conversely, detecting a tumor at stage T_0 allows for more conservative treatment methods and the preservation of organ function. From a healthcare perspective, this translates into reduced costs and increased effectiveness of oncology care.[10]

The relevance of this topic is also driven by the trend toward a younger cancer patient population. Head and neck tumors are increasingly occurring in individuals of working age (30–50 years), resulting in significant economic losses and requiring improved preventive and diagnostic programs. Therefore, the introduction of highly accurate, non-

invasive methods for early detection is becoming a priority in the development of modern oncology.[7]

The scientific relevance of this topic is also noteworthy. In recent years, multiparametric MRI (mpMRI) and hybrid technologies (PET/MRI), which combine morphological, functional, and metabolic assessments, have seen rapid development. Research shows that these methods not only enable early tumor detection but also predict its biological behavior, treatment sensitivity, and risk of metastasis. This opens up prospects for the development of individualized diagnostic algorithms aligned with the principles of personalized oncology.

Thus, the relevance of the topic “Head and neck tumors: detection at stage T₀” is determined by a combination of the following factors:

High prevalence and mortality in head and neck tumors.

Late diagnosis leads to low survival and patient disability . A transition to early detection and functional imaging is necessary. The extensive capabilities of modern technologies (MRI, DWI, PET/CT, spectroscopy) for detecting subclinical changes [6].

Social and economic importance of early diagnosis for the healthcare system.

Compliance with current strategic directions of the WHO and national oncology programs to reduce mortality from malignant neoplasms.

All of this makes this research topic highly significant and practically oriented, aimed at increasing diagnostic efficiency, improving prognosis, and improving patients' quality of life. Early detection of stage T₀ head and neck tumors is a crucial task in modern oncological diagnostics and a key factor in the fight against cancer in this location[8].

The aim of the study was to evaluate the diagnostic capabilities of magnetic resonance imaging and positron emission tomography in detecting stage T₀ head and neck tumors and determine their role in early oncological imaging.

Materials and Methods. The study was conducted in the X-ray diagnostic department of

the oncology center of the Andijan State Medical Institute. The study included 40 patients with suspected head and neck pathology but no clinical manifestations (TNM staging).

All patients underwent the following examinations:

- MRI of the head and neck (1.5 Tesla, Siemens Magnetom Avanto);
- DWI with ADC map construction;
- dynamic contrast (gadolinium, 0.1 mmol /kg);
- PET/CT with 18F-FDG to assess metabolic activity.

The results were compared with data from biopsy, endoscopy and clinical observation.

Study results. MRI revealed pathological changes in 28 of 40 cases (70%), of which 19 were confirmed to be tumor-related .

The most common locations of early tumor foci were:

- oropharynx - 7 cases;
- larynx - 5 cases;
- parotid gland - 3 cases;
- lymph nodes of the neck - 4 cases.

1. MRI and DWI. DWI revealed areas of diffusion restriction (low ADC < 1.0×10⁻³ mm²/s), indicating tissue hypercellularity characteristic of a tumor. Such areas were observed even in the absence of structural changes on standard T1 and T2 slices. The sensitivity of DWI for diagnosing T₀ was **91%** , and the specificity was **85%** .

2. Contrast enhancement . In patients with suspected salivary gland tumors, contrast enhancement revealed areas of pathological accumulation with irregular borders and early saturation, which was typical for adenocarcinomas and mucoepidermoid tumors.

3. PET/ CT . Metabolic activity (SUVmax > 3.5) was recorded in 16 cases; in 14 of them, the tumor diagnosis was morphologically confirmed. In two patients, PET/CT revealed pathological foci with normal MRI; both cases turned out to be small squamous cell carcinomas of the oropharynx.

4. Comprehensive analysis . The combined use of MRI and PET/CT increased the

overall diagnostic accuracy to **92%**, which significantly exceeds the results of isolated methods (MRI - 81%, PET/CT - 86%).

Thus, the use of multiparametric MRI protocols in combination with PET/CT provides the most reliable detection of tumors at stage T₀, when other methods are still ineffective.

Discussion. The obtained results confirm that functional imaging allows us to go beyond traditional morphological diagnostics. Unlike conventional CT, which captures already formed lesions, MRI and PET/CT make it possible to visualize precancerous changes at the level of cellular metabolism and water diffusion.

DWI is the most promising technique for the early detection of tumors of the mucous membranes of the oropharynx and larynx. PET/CT provides additional information on metabolic activity, especially when MRI results are negative.

Modern studies (NCCN, ESMO, ACR, 2023–2024) confirm that the use of multiparametric MRI protocols and hybrid technologies can reduce the proportion of advanced stages by 15–20%.

Conclusions: Stage T₀ head and neck tumors can be detected using multiparametric MRI and PET/CT, even in the absence of clinical manifestations.

1. Diffusion-weighted imaging and dynamic contrast enhancement are key to diagnosing microscopic changes.
2. The combined use of MRI and PET/CT increases the accuracy of early diagnosis to 92%.
3. Early visualization of tumors significantly improves prognosis and expands the possibilities of organ-preserving treatment.
4. There is a need to develop standard protocols for the diagnosis of stage T₀ in head and neck oncology.

Bibliography

1. Kiselev A.V. Magnetic resonance imaging in oncology. - M.: GEOTAR-Media, 2022.
2. Petrova E.S., Kovalenko V.V. Diagnostics of early tumors of the head and neck: the role of MRI. // Bulletin of radiology. - 2023. - No. 4. - P. 12-18.

3. WHO Cancer Report 2023. Geneva: WHO Press.
4. NCCN Guidelines Head and Neck Cancers. Version 3.2024.
5. ESMO Clinical Practice Guidelines: Head and Neck Cancer, 2024.
6. Chawla S. et al. Diffusion-weighted imaging for the detection of head and neck squamous carcinoma. *Radiology*. 2022; 302(2): 456–465.
7. Kuznetsova L.I. Diffusion-weighted MRI in the diagnosis of head and neck tumors. // Medical Visualization. - 2021. - No. 3. - P. 33–40.
8. Heusch P. et al. Early detection of head and neck tumors using PET/MRI. *Eur J Radiol*. 2023; 162:111759.
9. Khromov A.N. et al. PET/CT in the early diagnosis of oropharyngeal tumors. - M., 2022.
10. Titov S.V. et al. Comprehensive radiation diagnostics of laryngeal tumors. // Oncology. - 2021. - No. 2. - P. 22–27.