



CONTEMPORARY APPROACHES TO THE COMPREHENSIVE DIAGNOSIS OF MALIGNANT HEAD AND NECK TUMORS: A LITERATURE REVIEW

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Abstract

This article reviews contemporary approaches to the diagnosis of malignant head and neck tumors, with particular emphasis on the complementary role of clinical examination, imaging, endoscopic techniques, and morphological verification. The diagnostic capabilities of ultrasonography, multislice computed tomography (MSCT), magnetic resonance imaging (MRI), and positron emission tomography/computed tomography (PET/CT) are considered in relation to specific clinical tasks, including detection of the primary lesion, assessment of local tumor extension, evaluation of regional lymph nodes, identification of distant metastatic disease, and treatment planning. Particular attention is given to the role of histopathological examination and immunohistochemistry in establishing the definitive diagnosis and characterizing tumor differentiation and biological features. The analysis indicates that no single diagnostic modality is sufficient for comprehensive assessment of head and neck malignancies. The greatest clinical value is achieved through an integrated, indication-based diagnostic strategy in which each method is selected according to tumor location, suspected extent of disease, and the specific diagnostic question. Such an approach improves the accuracy of staging and provides a more reliable basis for individualized treatment planning.

Keywords: Head and neck cancer, malignant neoplasms, diagnostic imaging, multislice computed tomography, magnetic resonance imaging, positron



emission tomography/computed tomography, biopsy, histopathology, immunohistochemistry, staging.

Introduction

Malignant tumors of the head and neck represent a heterogeneous group of neoplasms arising from anatomically and functionally complex structures of the upper aerodigestive tract. Their clinical management is complicated by the close relationship of the primary tumor to the airway, major vessels, nerves, muscles, bones, and other critical anatomical structures. Consequently, accurate assessment of the primary lesion and its local and regional extension is essential not only for establishing the stage of disease but also for determining the feasibility and extent of surgical treatment and the need for radiation or systemic therapy.

Despite advances in oncological treatment and diagnostic imaging, delayed diagnosis remains an important clinical problem. Early lesions may produce limited or nonspecific symptoms, whereas clinically apparent manifestations may occur only after invasion of adjacent tissues or regional lymphatic spread. This emphasizes the importance of systematic clinical examination and appropriate selection of diagnostic procedures when a malignant process is suspected.

The diagnostic assessment of head and neck malignancies should not be regarded as a competition between individual imaging modalities. Rather, modern diagnosis is based on the complementary use of methods with different diagnostic strengths. Clinical examination and endoscopy provide direct assessment of mucosal abnormalities and localization of the suspected lesion. Cross-sectional imaging defines the anatomical extent of disease, while functional imaging may provide additional information regarding metabolically active lesions and systemic dissemination. Histopathological examination remains fundamental for definitive diagnosis.

An important clinical principle is therefore the distinction between **detection of a suspected lesion, anatomical characterization, disease staging, and definitive morphological verification**. These stages are interconnected but are not interchangeable. The appropriate diagnostic pathway depends on the



anatomical site, clinical presentation, suspected histological type, and potential pattern of tumor spread.

Aim of the Study

To evaluate the clinical significance and complementary diagnostic capabilities of contemporary methods used in the assessment of malignant head and neck tumors and to determine their role in establishing disease extent, staging, and treatment planning.

Objectives of the Study

1. To analyze the diagnostic capabilities of contemporary imaging and instrumental methods used in patients with suspected head and neck malignancies.
2. To assess the contribution of MSCT, MRI, PET/CT, ultrasonography, and endoscopic techniques to the evaluation of primary tumor extent and regional lymphatic involvement.
3. To determine the clinical role of morphological verification, including histopathological and immunohistochemical examination.
4. To assess the significance of an integrated diagnostic strategy for accurate staging and treatment planning.

Materials and Methods

The present study is a narrative review of contemporary national and international scientific literature concerning the diagnosis of malignant tumors of the head and neck. Published clinical studies, clinical practice guidelines, and scientific reviews addressing imaging, endoscopic, and morphological diagnostic approaches were analyzed.

Particular attention was given to the diagnostic role of MSCT, MRI, PET/CT, ultrasonography, endoscopic examination, biopsy, histopathological assessment, and immunohistochemistry. The methods were considered according to their principal clinical applications, including detection and localization of the primary



tumor, assessment of local invasion, evaluation of regional lymph nodes, detection of distant metastatic disease, and pre-treatment staging.

The analysis was based on the principle of complementary diagnostic value, taking into account the specific advantages and limitations of individual methods rather than considering any single modality as universally applicable.

Modern Diagnostic Methods and Their Clinical Significance

The diagnostic algorithm for head and neck malignancies begins with clinical assessment and, when indicated, endoscopic examination. These procedures establish the presence and anatomical location of a suspicious lesion and determine the need for further imaging and tissue sampling.

Multislice Computed Tomography

MSCT has an important role in the assessment of head and neck malignancies, particularly when evaluation of osseous structures is required. Its high spatial resolution allows visualization of cortical bone destruction, involvement of the mandible or maxilla, and the relationship of the tumor to adjacent anatomical structures. These characteristics make MSCT particularly valuable when bone invasion is suspected and during preoperative assessment.

However, CT has limitations in the characterization of certain soft-tissue interfaces. Therefore, when the principal diagnostic question concerns the extent of tumor infiltration into muscles, the tongue, or other soft-tissue structures, MRI may provide more detailed anatomical information.

Magnetic Resonance Imaging

MRI provides superior soft-tissue contrast and is particularly valuable for evaluating the local extent of tumors involving the tongue, floor of the mouth, pharyngeal spaces, muscles, nerves, and other soft-tissue structures. Assessment of the depth and extent of invasion may influence surgical planning and the determination of the appropriate treatment volume.

The principal limitation of MRI is that its diagnostic performance may be affected by motion, technical factors, and patient-related contraindications. Nevertheless,



for many soft-tissue diagnostic questions, MRI provides information that complements rather than duplicates CT findings.

Positron Emission Tomography/Computed Tomography

PET/CT combines anatomical imaging with assessment of tissue metabolic activity and therefore provides information that differs from conventional cross-sectional imaging. Its principal clinical value lies in disease staging in selected patients, evaluation of suspected recurrent disease, and assessment for regional or distant metastatic involvement.

At the same time, increased metabolic activity is not specific for malignancy and may also occur in inflammatory or infectious processes. Consequently, PET/CT findings should be interpreted in conjunction with clinical, anatomical, and morphological data rather than considered diagnostic in isolation.

Ultrasonography and Endoscopic Examination

Ultrasonography has particular value in the assessment of superficial structures and regional lymph nodes. Its advantages include accessibility, absence of ionizing radiation, and the possibility of repeated examinations. In selected clinical situations, ultrasound-guided procedures may also facilitate targeted tissue sampling.

Endoscopic examination provides direct visualization of mucosal surfaces and is particularly important when lesions are located in anatomically accessible regions of the upper aerodigestive tract. It complements cross-sectional imaging by allowing direct assessment of mucosal abnormalities and identification of areas requiring biopsy.

Morphological Verification

Regardless of the sophistication of imaging technologies, definitive diagnosis of a suspected malignant tumor generally requires morphological verification. Histopathological examination establishes the presence of malignancy and provides information regarding histological type, differentiation, growth characteristics, and other pathological features relevant to clinical management.



Biopsy technique should be selected according to the size, location, accessibility, and suspected nature of the lesion. In larger or infiltrative lesions, incisional biopsy is commonly used to obtain representative tissue, whereas complete excision may be appropriate for selected small and well-circumscribed lesions.

Immunohistochemistry provides additional diagnostic information when routine histological examination is insufficient for accurate classification. It may assist in determining tumor lineage, resolving differential diagnostic problems, and identifying biologically relevant markers in selected tumor types.

Thus, morphological examination should not be viewed as an alternative to imaging. Rather, imaging defines the anatomical context and extent of disease, whereas histopathology establishes the biological identity of the lesion.

Integrated Diagnostic Strategy

The clinical value of modern diagnostic methods is greatest when they are incorporated into a structured diagnostic algorithm. The initial clinical assessment identifies suspicious lesions and determines the need for further investigation. Endoscopy may provide direct visualization of mucosal abnormalities, while CT and MRI are selected according to the anatomical structures that require assessment.

PET/CT has a more specific role in staging and assessment of suspected recurrent or metastatic disease. Tissue sampling remains necessary when histological confirmation is required. Accordingly, the diagnostic process should be individualized rather than based on routine application of all available technologies.

This approach also reduces unnecessary duplication of examinations and allows diagnostic resources to be directed toward the clinical question most relevant to each patient.

Discussion

The reviewed evidence indicates that the diagnostic value of modern methods is determined not only by their technical capabilities but also by the clinical context in which they are applied. CT, MRI, and PET/CT provide different types of



information and therefore should be considered complementary rather than interchangeable techniques.

CT is particularly useful when evaluation of bone involvement is required, whereas MRI provides greater soft-tissue contrast and is therefore valuable for determining local tumor extension. PET/CT contributes additional metabolic information and may improve assessment of disease distribution in appropriately selected patients. Ultrasonography and endoscopy provide further information that may be difficult to obtain from cross-sectional imaging alone.

An important limitation of current diagnostic strategies is that imaging findings may not reliably distinguish malignant lesions from inflammatory, reactive, or treatment-related changes in every clinical situation. This is one of the principal reasons why morphological verification retains a central role in the diagnostic pathway.

The available evidence also supports a shift from a modality-centered approach toward a clinically integrated model of diagnosis. In this model, the diagnostic method is selected according to the specific question requiring clarification: detection of a suspicious lesion, assessment of local invasion, evaluation of regional lymph nodes, search for distant disease, or histological classification.

Such an approach is particularly relevant in head and neck oncology, where anatomical complexity and the functional importance of adjacent structures require accurate characterization of disease before definitive treatment.

Conclusion

Contemporary diagnosis of malignant head and neck tumors should be based on an integrated and clinically justified combination of examination, endoscopic assessment, cross-sectional imaging, functional imaging, and morphological verification. MSCT, MRI, and PET/CT provide complementary information concerning anatomical tumor extent, soft-tissue involvement, osseous invasion, regional lymphatic disease, and distant dissemination.

The principal clinical advantage of a comprehensive diagnostic strategy lies not in the simultaneous use of all available technologies, but in the appropriate selection of each method according to the anatomical site, suspected stage, and



specific diagnostic objective. Histopathological examination remains fundamental for definitive diagnosis, while immunohistochemistry provides additional classification in diagnostically complex cases.

Further development of diagnostic algorithms should focus on improving the integration of morphological, anatomical, and functional information, standardizing diagnostic pathways, and strengthening evidence-based criteria for selecting individual imaging modalities. Such an approach may contribute to more accurate staging, better treatment planning, and improved clinical outcomes for patients with malignant head and neck tumors.

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Modern American Journal of Medical and Health Sciences

ISSN (E): 3067-803X

Volume 2, Issue 6, June 2026

Website: usajournals.org

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