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Precision Medicine in Head and Neck Cancer: Role of MRI in Patient Detection

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Description

The most prevalent forms of head and neck cancer typically manifest in the lip, mouth and larynx. Indications commonly include persistent sores or alterations in voice quality. Additionally, cancerous growths can originate from facial skin, potentially causing breathing difficulties due to their location. The majority of head and neck cancer cases stem from alcohol or tobacco consumption, including smokeless tobacco, with an increasing number associated with Human Papillomavirus (HPV) infection. Other risk factors encompass betel quid use, radiation exposure and certain occupational hazards. Approximately 80% of cases are histologically classified as squamous cell carcinomas, confirmed through tissue biopsy. The extent of local tissue invasion and distant metastasis is evaluated through clinical imaging and blood tests. In various cancer sites, radiotherapy integrated with MRI has transitioned from experimental to clinical application. However, the use of MRI for radiotherapy planning remains underdeveloped, and solely MRI-based target delineation is not yet standard practice for Head and Neck Cancer (HNC) treatment.

Cancer assessment

MRI's weighted sequences yield excellent anatomical detail due to enhanced visibility of fat planes, bone marrow signal and lymph node vessels. By adhering to the principle of delineating fat planes, MRI offers optimal assessment of various structures including the nasopharynx, parapharyngeal fat plane, floor of mouth, oropharynx, preepiglottic space and false vocal cords. Fat yields high signal, while low signal is characteristic of fluid, air, hyperacute hemorrhage, densely calcified or ossified lesions, fibrous tissue and vascular flow voids. On the other hand, Magnetic Resonance Imaging (MRI) offers a unique advantage in examining pathological processes at the molecular level, thereby providing superior soft tissue contrast compared to other modalities. This makes it ideal for distinguishing between edema and tumor infiltration and for assessing deep infiltration of the primary tumor. Additionally, MRI facilitates the evaluation of bone marrow invasion and regional nodal disease.

It is the preferred method for local assessment of the suprahyoid neck, including the nasopharynx, sinuses, oral cavity and oropharynx. Radiology plays a pivotal role across all oncology subspecialties, contributing significantly to diagnosis, staging and treatment. Its wide-ranging utility spans from its initial use as a diagnostic tool for cancer detection, followed by the staging and monitoring of the disease, to the delivery of appropriate treatment protocols. Head and neck cancer encompasses various subsites such as the oral cavity, sinuses, salivary glands, hypopharynx and larynx. These tumors constitute a significant portion of overall malignancies, ranking as the fifth most common cancer type. Among the skin cancers affecting the head and neck, basal cell carcinoma predominates, followed by squamous cell carcinoma and melanoma.

MRI detection

Due to its exceptional soft tissue contrast, Magnetic Resonance Imaging (MRI) has become increasingly integral in radiotherapy, enabling precise visualization of tumors and identification of critical organs in various regions. Particularly in the Head and Neck (HN) area, MRI distinguishes tumor subsites from Organs at Risks (OARs) with high accuracy. Consequently, in clinical practice, there's frequent utilization of MRI scans for improved tumor delineation accuracy by registering them with planning CT images. Symptoms of head and neck cancer may include non-healing sores in the oral cavity or facial region, difficulty in swallowing or changes in voice.

Advanced stages might manifest as sudden bleeding, facial pain, numbness, or visible neck or oral cavity lumps. Initially, benign signs such as enlarged lymph nodes, a persistent dry cough, or sore throat may persist over time. Other indicators encompass persistent earaches, tongue or mouth ulcers, bleeding, numbness, bad breath, or discoloration. For nasopharyngeal carcinoma, high-conformity intensity-modulated radiotherapy offers distinct advantages. However, significant anatomical changes in external contour, shape and target location necessitate dosimetric adjustments. MRI, a radiological imaging technique, plays a pivotal role in depicting bodily anatomy and physiological processes without ionizing radiation, unlike CT and PET scans.