Multi-Slice Computed Tomography Imaging of Oral and Oropharyngeal Cancer

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Abstract

In most cases, the volume of formations localized on the mucous membranes of the head and neck is squamous cell carcinoma. The purpose of medical imaging is not only to determine the histological structure of the formation but also to assess its spread into the surrounding tissues in order to determine the disease stage and pathology for treatment.

Study Aim: To study the multi-slice computed tomography (MSCT) semiotics of oral and oropharyngeal cancer.

Materials and Methods: MSCT was performed in spiral mode using a Somatom Emotion 6 (Siemens, Germany). In the process of postprocessing, mandatory evaluations of multiplanar reformed (MPR) images in the sagittal and frontal as well as oblique projections were performed. To determine the boundary of the volume formation, the degree of adhesion to the surrounding structure, and the expansion of the neoplasm, MSCT with intravenous contrast was performed in 13 patients. The scanning area included the area from the base of the skull to the jugular notch. Thirty patients (25 men, 5 women) from 41 to 73 years old were examined. MSCT results in all cases were compared with histological data.

Results: Of the 30 total patients, 12 (40%) had a tumor localized in the area of the tongue, 6 (20%) in the area of the bottom of the oral cavity, 7 (23.3%) at the tonsils, 3 (10%) at the soft palate, 1 (3.3%) at the cheek mucosa, and 1 (3.4%) at the alveolar process. Regarding the tumor advancement, 12 patients had stage T3 (40%), 7 had stage T4 (23.3%), 9 had stage T2 (30%), and 2 had stage T1 (6.4%). Regarding the degree of lymph node lesion, 14 had stage N1 (46.7%), 10 had stage N2 (33.3%), and 2 had stage N3 (6.7%). In 2 cases (6.7%), a lesion of the lower jaw was detected.
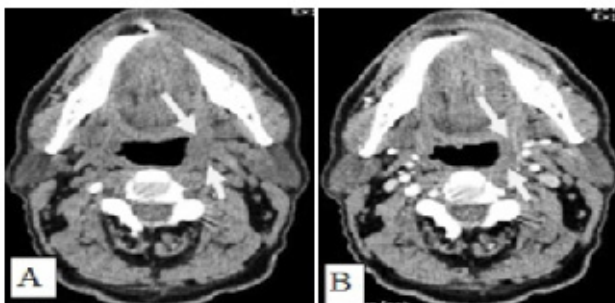
Figure 1: Patient K., 68 years old. Oropharyngeal MSCT in axial projection: A. Native study, B. With intravenous bolus contrast. A small infiltrative tumor of the oropharynx (left palatine tonsil stage T1). The boundaries of the tumor are not differentiated, the accumulation of contrast is weak (density indicators in the native phase of the study are 45 units.N; after intravenous bolus amplification: 56 units.H). The displacement of the left wall of the oropharynx, the smoothness of the contour (arrows) is determined.

It was found that the MSCT semiotics of oral and oropharyngeal cancer corresponded to the magnetic resonance imaging (MRI) semiotics and included direct and indirect signs. Direct signs of the formation of malignant were volumetric proliferation of pathological tissue, thinning of the fat layer or complete obliteration of fat spaces, infiltration of muscle tissue and bone destruction. Indirect signs were structural heterogeneity of the tissue (in the presence of necrosis) and changes in density indicators after the introduction of a contrast agent during MSCT.
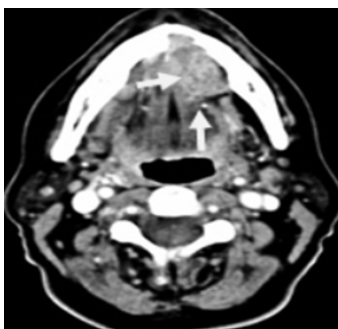
Figure 2: Patient D., 55 years old. Oral MSCT with intravenous bolus contrast in axial projection. Tumor of the anterior parts of the bottom of the oral cavity of the T4 stage. A tumor-like formation with dimensions of 4.5×3.5 cm (arrows) and an inhomogeneous structure was revealed. Invasion of the tumor in the lower jaw was noted.

Contrast accumulates moderately. The accumulation of contrast by lymphoid tissue can complicate the diagnosis. The key to the correct diagnosis and determination of the extent of tumor spread is understanding the anatomy of the cellular spaces and layers of the neck.

Figure 3: Patient Sh., 44 years old. MSCT in axial projection with intravenous bolus contrast. A small tumor at the bottom of the oral cavity with transition beyond the middle line was noted (arrows). Infiltration of fatty spaces of the bottom of the oral cavity was seen.

Using MSCT, it was difficult to detect small tumors (stage N1) and their borders due to the low contrast as well as presence of neoplasms with superficial spread. At the same time, 72.0% of the examined patients had stage T3 or T4 tumor advancement, and after additional administration of a contrast agent, the tumor contrast increased. With the increase in the size of the tumor, heterogeneity of amplification was observed due to the presence of necrosis.

The fat spaces of the hyoid region in the normal state are a symmetrical zone of low density between the maxillofacial and chin-hyoid muscles. Obliteration of the fatty spaces of the sublingual area serves as the main indicator of a tumor lesion when small formations of the bottom of the oral cavity are detected.
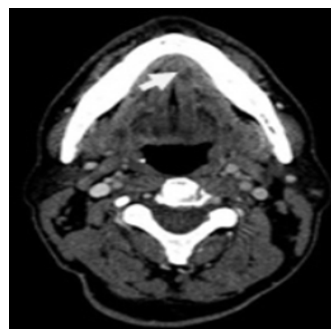

Figure 4: Patient Z., 58 years old. Oral MSCT with intravenous bolus contrast. In the anterior parts of the bottom of the oral cavity, a low-density area with dimensions of 0.8×0.4 cm was differentiated centrally and to the left (arrows). The accumulation of contrast was weak, and the density indicators were 65-67 units.N. The boundaries of the tumor were not clearly defined, but no spread beyond the middle line was detected. Obliteration of fatty tissue of the sublingual area on the left was noted. On the right, the fat layers were differentiated, but the muscles were not changed. The lymph nodes of the neck were not enlarged.

Figure 5: Patient Z., 41 years old. Oropharyngeal MSCT in axial projection with intravenous bolus contrast. A stage T2 tumor of the left lateral surface of the tongue in the middle third was noted. A slit-like ulcer was surrounded by a rim of increased density (arrows).

It was difficult to detect small tumors (stage T1 or T2) located in the anterior parts of the bottom of the oral cavity due to the proximity of bone tissue and teeth and the presence of filling material due to pronounced artifacts from dense structures.
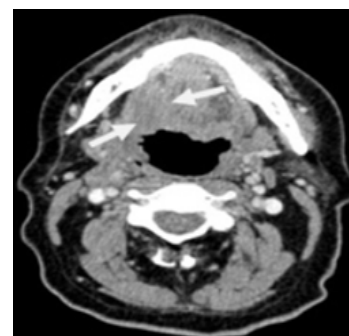

Figure 6: Patient E., 63 years old. MSCT of the oral cavity showing the oropharynx in axial projection with intravenous bolus contrast. In the area of the root of the tongue and the middle third, a tumor node 6.4×4.5 cm in size was visualized without signs of necrosis, with infiltration of fat spaces on the right (arrows). The tumor accumulated contrast material, increasing the density to + 80 HU.

In some cases, visualization was facilitated by the presence of an ulcerative defect in the structure of the tumor. In all tumors of stages T3 or T4, an increase in density was determined after the introduction of a contrast agent, with the edges clearly visualized relative to the surrounding tissues. In all tumors of stages T3 or T4, it was possible to determine the size of the tumor and assess its infiltration and spread to neighboring zones as well as beyond the median line.
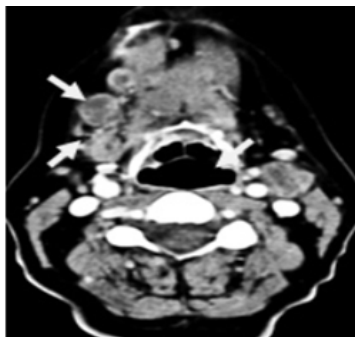

Figure 7: *Patient A., 54 years old. Oropharyngeal and neck MSCT in axial projection with intravenous bolus contrast. Cancer of the tongue with metastases to the lymph nodes of the middle jugular group. There was contrast of the affected lymph nodes along the periphery in a low-density central necrosis zone (arrows). Bilateral defeat.*

There were no difficulties in identifying tumor nodes of stage T3 or T4 lesions, which had all of the above-mentioned signs in various combinations among 26 studies. Of the 30 patients examined by MRI, 26 (86.7%) had metastases in the lymph nodes of the neck. Lymph nodes of level III were the ones mainly affected. Signs of metastasis of squamous cell carcinoma in the lymph nodes were an increase in the node size to >1.0 cm, a change in the node shape from bean-shaped to rounded, structural disorders in the node, blurring of the external contours of the node and compaction of the surrounding adipose tissue on CT. In our studies, destruction of the lower jaw was revealed in 4 patients (3.0%) with a primary diagnosis of a tumor lesion of the oral cavity. The foci of lysis were represented on CT images as areas of violation of the integrity or erosion of the cortical layer. A sign of bone marrow damage during CT was the replacement of low-density regions in normal adipose tissue with soft tissue density.
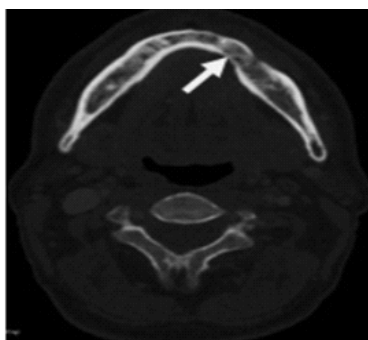

Figure 8: *Patient K., 56 years old. MSCT of the oral cavity in axial projection in bone mode. The tumor at the bottom of the oral cavity detected in soft tissue mode on the left adhered to the mucous membrane of the alveolar edge of the lower jaw. In bone mode, the focus of destruction of the cortical layer of the lower jaw on the left was revealed.*

Conclusion

MSCT is highly effective for detecting tumors of the oral cavity and oropharynx as well as for assessing the extent of the spread of tumor advancement. However, the algorithm concerning radiation diagnostics for patients with malignant formations of the oral cavity and oropharynx should include an MSCT study with intravenous bolus contrast.

Acknowledgement

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