The aim of the investigation was to evaluate the possibilities of radiological methods in differential diagnostics of salivary gland masses. 

Materials and Methods. 76 patients with tumors and tumor-like salivary gland masses were examined. We analyzed the findings of their physical examination, and performed operative interventions compared to the data of histological verification, multiplanar reconstruction sialography and ultrasound investigation.

Results. At clinical examination the symptoms were non-specific. 97.5% of patients presented with a constant mass in the affected salivary gland. In 14.5% of patients the mass grew during the last 3–4 months; and in 2.5% of patients it was an incidental finding and had no manifestations. The mostly involved glands (96% of cases) were parotid and submaxillary salivary glands. Tumor-like masses were found in 16 patients (21%), benign tumors — in 57 (75.0%), malignancies and locally destructive tumors — in 3 (4.0%).

Conclusion. High resolution ultrasound is the primary diagnostic technique of neoplastic masses of major salivary glands, and allows a reliable evaluation of the mass localization, shape, size, structure, borders, and vascularisation. Multiplanar reconstruction sialography enables to assess more precisely anatomical localisation of tumors and tumor-like masses of salivary glands with duct system, adjacent bone and soft tissue structures.

Key words: salivary glands; tumours; tumour-like masses; multiplanar reconstruction sialography; ultrasound investigation.
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native examination (with comparative assessment of the shape, size, borders and density of the studied gland with a contralateral SG on symmetrical areas);

• contrast enhancement of a ductal system of the studied SG (according to a modified technique of I.F. Romacheva et al., 1987) was followed by the administration of iodine containing radiopaque contrast agent (320–350 mg I/mL) to the extent of 2–3 mL using a plastic catheter, 0.6 mm in diameter, through the excretory duct of the gland.

I.F. Romacheva scheme (1973) was used in the assessment of multidetector CT sialography picture on axial sections, in multiplanar and three-dimensional (3D) reconstructions.

The analysis of the findings included:
• the filling quality of the SG excretory duct (uniformity, contour, diameter (narrowing/ectasia), filling defect and contrast depot);
• the presence of filling defects or cavities (a contrast agent depot) of ductal system in the area of SG parenchyma;
• topographic and anatomical characteristics of SG masses in relation to other structures (tongue, muscles, teeth, jaws, etc.).

Morphological study of biopsy or surgical material was performed in all cases of SG masses to determine the nature of the process.

Results and Discussion
Clinicopathologic characteristic of SG masses
1. Clinically — the symptomatology was non-specific. 97.5% of cases were distinguished by the presence of a constant mass in the affected SG, which expanded over the last 3–4 months in 14.5% of patients. In 2.5% of cases a SG mass was an incidental finding and had no manifestation. There were predominantly (96%) involved parotid SG (PSG) and submandibular SG (SMSG), sublingual SG (SLSG) masses were found in 4% of cases.

Visual examination of all patients with SG tumors and tumor-like masses revealed no skin changes. There was swelling of various degrees depending on the mass size. 27 patients (35.5%) had tenderness on palpation, 10 (13%) — enlargement and slight tenderness of the regional lymph nodes and palate tonsils.

SG masses had no specific clinical signs, and could be differentiated only by the comparison of the findings of radiological methods and morphological verification.

2. Morphological type of the masses corresponded to:
   tumor-like masses (n=16; 21%), among them 2 (2.5%) cases were diagnosed as Stafne pseudocysts — a result of SMSG accessory lobule ectopia into the mandible, 3 (4%) cases — retention cysts developed from SLSG ducts and lobules — ranulas, the rest 11 (14.5%) cases had the cysts located in SG parenchymal part;
   benign tumors (n=57; 76.5%), among them pleomorphic adenomas were the most common (n=48; 63.3%) characterized by a variety and heterogenicity of structure, and consisting epithelial and mesenchymal components, lipomas were diagnosed in 7 (9.2%) cases due to SG fatty hyperplasia (in Madelung’s disease as well), teratoderms of the mouth floor were found in 2 (2.5%) patients;
   malignant locally destructive tumors (n=3; 4%) in the form of stage I acinic cell carcinomas (T1), which did not exceed 2.0 cm in its maximum dimension, were located in the gland parenchyma, did not spread beyond the capsule, and consisted of basophil cells resembling albuminous cells of the gland acinus.

Comparison of clinical findings, the results of morphological verification and multiplanar reconstruction sialography

1. Tumor-like masses.
   Ranulas (n=3; 4%) were located under the tongue, in the anterior part of the mouth floor, had heavy elastic consistency, the mucosa above them was flexible, thin, cyanotic. There were no reactive changes of the surrounding tissues and regional lymph nodes. Morphological study of ranulas revealed connective tissue of various maturity degrees (fibrous, granulation), its boundaries penetrating the connective tissue interlayers of SLSG lobules.

On native tomograms a mass was not differentiated from anatomical structures of the mouth floor (Fig. 1, a). Multidetector CT sialography with multiplanar and 3D-reconstructions (Fig. 2, b, c) enabled to obtain reliable diagnostic information and detect in 2 patients (2.6%) — one cystic cavity and in 1 patient (1.3%) — two cystic cavities connected among themselves by a fistula (n=1; 1.3%).

Stafne pseudocysts (n=2; 2.5%) represented a dystopic accessory SG lobule (submandibular SG, rarely — sublingual SG) in the mandible with the surrounding bone depressed, with a cortical defect on oral side. They were incidental findings and had no clinical manifestations.

Native multidetector CT showed bone defects reaching 0.5–1.5 cm, of round shape, with sclerotic margins, containing the components of liquid and fat density. Sialograms demonstrated a contrast invariable ductal

![Fig. 1. Multidetector CT images: a — native investigation, axial section; b — sialogram, multiplanar reconstruction; c — sialogram, 3D-reconstruction, show ranula (a cavity with clear contours) after SLSG ductal system contrast enhancement (arrows)
Cysts (n=11; 14.5%) at parenchyma level were diagnosed most frequently (81.8%) in PSG. On palpation there were determined painless, non-mobile tumor-like masses of dense elastic consistency. There were revealed no skin changes above them and no reactions of regional lymph nodes.

Native multidetector CT showed 1.5–2-fold enlargement of the SG of interest compared to the contralateral side, its sharp borders differentiating against the background of surrounding fatty interlayers, fascias and muscles. The gland was heterogeneous due to the areas of soft tissue and liquid density. The cyst could be differentiated from the surrounding tissues using sialography, which enabled to visualize a mass of liquid density, of round or oval shape, with clear even borders at the level of one of the gland poles. Ductal system was observed at all levels, with no signs of duct ablation and deformity of ducts. Cysts caused dislocation of ducts pushing them aside, forward and downward (Fig. 3, b, c).

Ultrasound provided a more reliable diagnostic picture representing a cyst as a mass of liquid density, of homogeneous or heterogeneous structure due to the inclusions (cholesterol crystals), and surrounded by a capsule. All cysts were avascular, with no blood flow changes observed along the periphery (Fig. 4, a–c).

Cysts should be differentiated from cystic formations,
which are characterized by the cavities filled with fluid or heterogeneous content, in particular, by the presence of cystic cavity with a wall of ectopic derma with perspiratory and sebaceous glands, and containing a porridge-like mass of desquamated epidermis and cholesterol, and referred to dermoid cysts (teratodermoids). They can occur in various parts of maxillofacial area, and their preferred location is mouth floor, where they locate in between the mandibular internal surface and the hyoid bone. Most teratodermoids are benign, though sometimes can become malignant. Depending on a growth direction and topographo-anatomical locations, sublingual and submental cysts are distinguished. Clinically, they are solitary or, rarely, multiple expansively growing masses. Multidetector CT signs of dermoid cysts are characterized by the presence of a cystic cavity connected with the mandible or hyoid bone by an orifice. The content of a dermoid cyst is heterogeneous: fatty, fluid, or soft tissue. The surrounding structures appear dislocated at the mass level, and if cysts are large-sized, their atrophy due to pressure can occur (Fig. 5, a–d).

2. Benign tumors.

All benign tumors were characterized by scanty clinical presentation and expansive growth. Multidetector CT sialograms represented them as inclusions of soft tissue or fat density with clear boundaries. There were no ducts discontinued, the ducts being located to a greater or lesser degree depending on a tumor size. In large masses the surrounding SG parenchyma looked thin due to atrophy.

The most common tumors were pleomorphic adenomas (n=48; 63.3%) characterized by heterogeneous structure containing epithelial and mesenchymal components. On palpation adenomas were dense, painless, non-adherent with surrounding tissues. Skin integument above the adenomas was of usual color, there were no hyperplastic changes of regional lymph nodes.

On ultrasound, adenoma presented as a hypoechogenic mass, with smooth or irregular, but always clear margins, with a well differentiated capsule. The tumor structure was determined to be heterogeneous. In most cases Doppler US revealed the small diameter vessels with low-speed blood flow (up to 10–20 cm/s) along the mass periphery, or the absence of vascularization signs (Fig. 6, a, b).

Native examination and multidetector CT sialography showed the interested SG to be enlarged in size, with clear margins, and differentiated surrounding tissues. The adenoma was visualized as a soft tissue conglomerate deep in the gland or in one of the gland poles (Fig. 7, a–c).

7 patients (9.2%) were found to have non-epithelial benign masses consisting of fatty tissue — lipomas (sialolipomas). Their diagnosis was of no difficulty, since multidetector CT image was very specific: a well-delineated area of low, fat density with regular margins was seen against the background of SG parenchyma of liquid density (Fig. 8, a–c).


Locally destructive acinic cell carcinomas of SG were found in 4% (n=3) of cases. All were women over 40. One
female patient was reliably found to have the malignization of pleomorphic adenoma. On palpation the tumor presented as a dense painless node with indistinct boundaries, there was observed the enlargement of regional lymph nodes (submandibular and cervical). Ultrasound revealed in the gland an irregular-shaped mass of heterogeneous structure, with sharply reduced echogenicity. In all cases there was well determined a feeding vessel approaching a tumor node, the characteristic feature being the increase of a peripheral blood flow (over 30–40 cm/s). Two female patients had a high-degree vascularization of the tumor itself, and only one tumor had a moderate degree of blood supply (Fig. 9, a–c).

Computer tomograms showed the interested SG to be enlarged due to a heterogeneous mass (inside the tumor there were areas of liquid and soft tissue density), with irregular, and occasionally, indistinct boundaries. The changes of regional lymph nodes were assessed on multidetector CT images by analyzing their size, boundaries, shape, and the integrity of fat interlayers along the periphery. A round shape lymph node, the enlargement of the maximum size up to the level of over 0.8–1 cm, the heterogenous structure, indistinct margins, an increased density of the surrounding fatty tissue indicated the presence of reactive changes, which could be consistent with hyperplasia or metaplastic lesion (Fig. 10).
Multidetector CT sialography enabled to demonstrate more adequately the expansion of destructive changes in SG due to the tumor soft tissue proliferation in parenchyma. In all cases the ductal system was deformed, displaced, there were observed discontinuity of the ducts. 3D-reconstructions enabled to improve the spatial perception of SG ductal system, assess topographo-anatomical characteristics of the tumor (Fig. 11, a, b).

The assessment of multidetector CT sialography efficiency in the diagnosis of tumor and tumor-like masses...
were the following: sensitivity — 100%; specificity — 95.0%; accuracy — 97.0%; positive predictive value — 95.0%; negative predictive value — 100%.

**Conclusion.** High resolution ultrasound is the primary diagnostic technique of neoplastic processes of major salivary glands, and enables to evaluate reliably the mass localization, shape, size, structure, margins and blood supply level. Multidetector computer tomographic sialography using multiplanar and 3D-reconstructions enables to assess more precisely topographical-anatomical relations of tumors and tumor-like masses of salivary glands with duct system, adjacent osseous and soft tissue structures and makes it possible for a clinician to determine the management of the operative therapy.

**References**