

Ultrasonic Characteristics of Salivary Gland Tumors

Rizvan Yagubovich Abdullaiev*, VV Lysenko and SG Efimenco

Kharkov Medical Academy of Postgraduate Education, Ukraine

***Corresponding Author:** Rizvan Yagubovich Abdullaiev, Professor, Head of the Department of Ultrasound Diagnostics of Kharkov Medical Academy of Postgraduate Education, Ukraine.

Received: November 01, 2017; **Published:** November 15, 2017

Among tumors of the salivary glands, about 70% are located in the parotid, 22% in the small salivary glands, including sublingual glands and 8% in the submandibular gland. Overall 80% of all parotid masses are benign and the majority of these are pleomorphic adenomas. Pleomorphic adenomas is the most common tumor (~50%) of the parotid. Salivary gland cancer is rare, with 6% of head and neck tumors forming in the salivary glands, the majority in the parotid [1-4].

Warthin's tumour: Second most common benign salivary gland neoplasm, representing about 6 - 10% of all parotid tumors. They rarely occur in other glands and 12% are bilateral. They present most often in the sixth decade in women and the seventh decade in men [5].

Carcinomas are often further classified as high grade, low grade or mixed, the latter inferring a variable behaviour depending on the histological picture. Except in the case of mucoepidermoid tumors, the clinicopathological correlation has proved unreliable. It should be recognised that the clinical behaviour rather than the histology of a tumor provides a better treatment guide and it is important to consider clinical factors in addition to histology and grade when planning treatment [6].

Ultrasound is the usual initial means to assess superficial lesions. Ultrasound is more limited at visualizing the deep lobe of the parotid and some minor salivary glands depending on location. Especially difficult for the method are tumors of retropharyngeal localization. If deep tissue extension is suspected or malignancy confirmed on cytology, an MRI or CT scan is used to evaluate tumor bulk, local invasion and perineural spread [7-10].

Ultrasound plays an important role in the diagnosis of space-occupying lesions. Some studies found that ultrasound was able to differentiate between benign and malignant parotid masses with high accuracy while other studies presented opposing conclusions [11,12]. The sensitivity of the echography is above 95%. The specificity of ultrasonography is less than 90%, since it is not always possible to clearly differentiate between tumor and non-tumorous diseases of the salivary glands. In the diagnosis of palpable formations, the specificity of echography exceeds 95%.

When interpreting the revealed gland masses, the following echographic features should be taken into account: including dimensions, shape (oval, lobulated or irregular), margins (circumscribed, spiculated or ill-defined), echogenicity (anechoic, hypoechoic, isoechoic or hyperechoic), echotexture (homogeneous or heterogeneous) and vascularization. Vascularization was assessed in four grades: Grade 1 indicates no vessels visible in the mass in color Doppler flow imaging (CDFI) low-flow mode; Grade 2 indicates a few vessel segments of no more than three blood vessels visible in the whole mass; Grade 3 indicates up to five vessels visible in the mass; and Grade 4 indicates more than five vessels visible in the mass [13].

Most often (from 60 to 90% of cases) is diagnosed a benign salivary gland tumor - pleomorphic adenoma. It is followed by Warthin tumors (adenolymphoma, cystadenolymphoma, papillary cystadenolymphoma). Clinically large tumors manifest themselves in the form of painless formations, and small ones are detected accidentally during ultrasound examination. Pleomorphic adenoma is more common in women in the form of solid formation of one-sided localization, is prone to malignancy. The echographically pleomorphic adenoma is

hypoechoic, well revealed in the form of focal lesions with a weak dorsal pseudo enhancement, sometimes with the presence of small hyperechoic inclusions – calcification. In most cases, the echostructure of the pleomorphic adenomas differs in polymorphism (Figure 1-10).



Figure 1: Pleomorphic adenoma. Sonographic image shows hypoechoic ovoid shape mass in the left parotid with circumscribed margin, homogeneous structures, with posterior echogenicity enhancement.

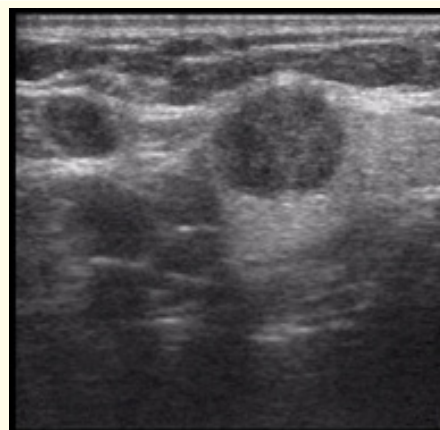


Figure 2: Pleomorphic adenoma. Sonographic image shows mild echogenicity, round shape mass in the left parotid with well-defined margin, mild heterogeneous structures, with posterior echogenicity enhancement.

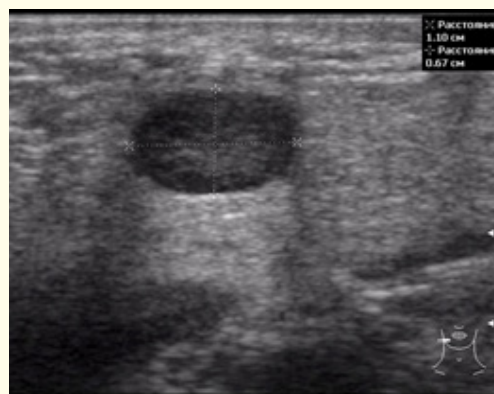


Figure 3: Pleomorphic adenoma. Sonographic image shows mild echogenicity, ovoid shape mass in the left parotid with a horizontally long axis, posterior echogenicity enhancement and lateral shadow.

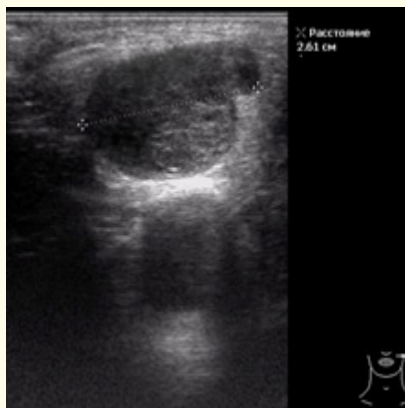


Figure 4: Pleomorphic adenoma. Sonographic image shows wrong shape mass in the right parotid with mild heterogeneous structures, with posterior echogenicity shading.



Figure 5: Pleomorphic adenoma. Sonographic image shows wrong shape mass with a horizontally long axis in the right parotid, with mild heterogeneous structures.

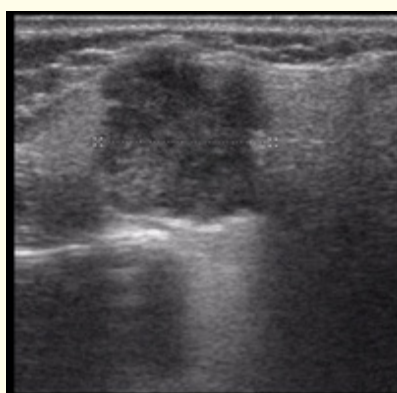


Figure 6: Pleomorphic adenoma of right parotid. Sonographic image shows irregular shape mass with a fuzzy contour, mainly reduced echogenicity, with minimal heterogeneity of the echostructure, partial dorsal pseudo enhancement.



Figure 7: Pleomorphic adenoma of submandibular salivary gland. Sonographic image shows a small mild echogenicity, round shape mass with well-defined margin, homogeneous structures, with posterior echogenicity enhancement.



Figure 8: Pleomorphic adenoma of submandibular salivary gland. Sonographic image shows a small heterogeneous, round shape mass with well-defined margin and with the presence of hyperechoic small linear inclusions.

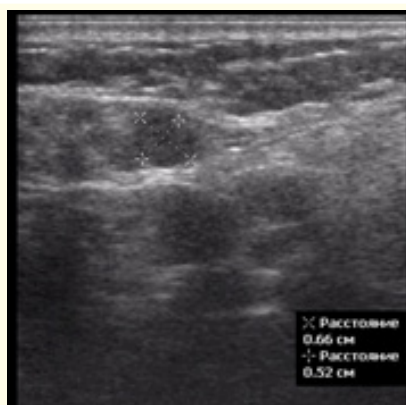


Figure 9: Pleomorphic adenoma of submandibular salivary gland. Sonographic image shows a very small homogeneous, hypoechoic round shape mass with well-defined margin.



Figure 10: Pleomorphic adenoma of submandibular salivary gland. Sonographic image shows a large oval shape mass, heterogeneous structure, with an even contour, without dorsal pseudo-enhancement.

Adenolymphoma (Warthin’s tumor) - lymphomatous cystadenoma is 6 - 10% of all salivary gland tumors, more often localized in the parotid salivary gland. Echographically, the tumor usually has an oval shape, decreased echogenicity, a clear, even contour, often includes small anechoic areas, with enhanced vascularization. In most cases, the echostructure of the tumor has a mixed cystic and solid structure, including fluid-containing cavities with thin septa (Figure 11,12).



Figure 11: Adenolymphoma of the parotid gland. Sonographic image shows a large sizes irregular shape mass, decreased echogenicity, heterogenic structure with hyperechoic inclusion and dorsal pseudo-enhancement.

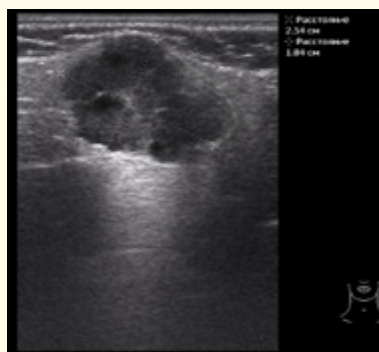


Figure 12: Adenolymphoma of the parotid gland. Sonographic image shows a large sizes irregular shape mass, decreased echogenicity, heterogenic structure with anechoic inclusion and weak dorsal pseudo-enhancement.

In color and energy Doppler studies, there are no specific signs of differential diagnosis of pleomorphic adenoma and adenolymphoma. In most cases, vascularization of the tumor with pleomorphic adenoma is peripheral, it is weak or moderately pronounced. Frequency of occurrence of densely located color vascular signals along the periphery of the tumor with adenolymphoma is somewhat higher than with pleomorphic adenoma. In adenolymphoma, vascular signals can also be detected on partitions (Figure 13-20).

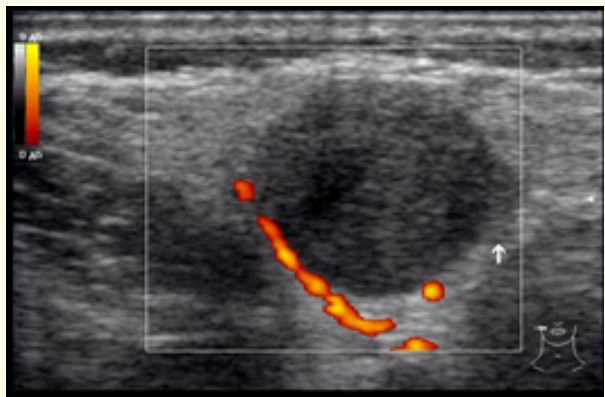


Figure 13: Pleomorphic adenoma of parotid. Grade 1 vascularization in power Doppler imaging – no vessels visible in the mass.

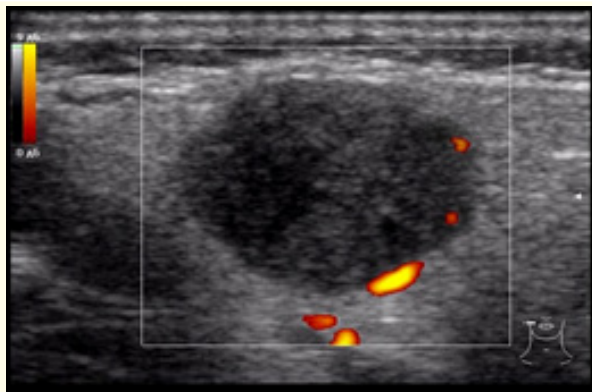


Figure 14: Pleomorphic adenoma of parotid. Grade 2 vascularization in power Doppler imaging – two small vessels visible in the mass.

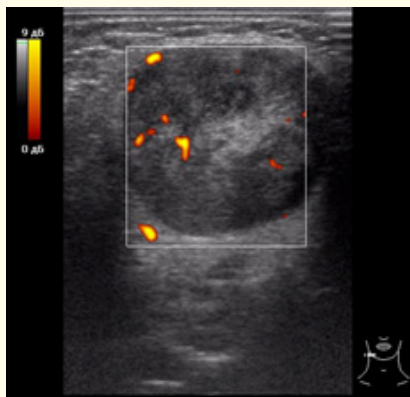


Figure 15: Pleomorphic adenoma of submandibular salivary gland. Grade 3 vascularization in power Doppler imaging – up to five vessels visible in the mass.

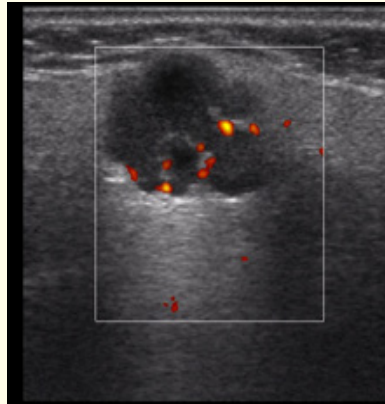


Figure 16: Pleomorphic adenoma of submandibular salivary gland. Grade 4 vascularization in power Doppler imaging – more than five vessels visible in the mass.

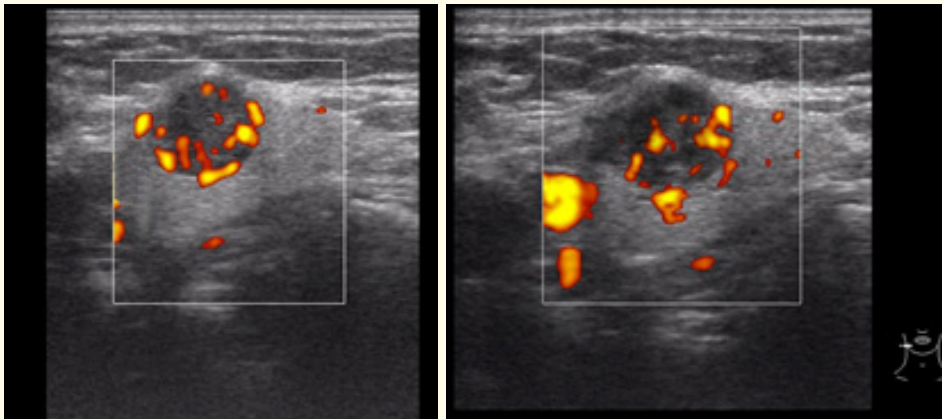


Figure 17, 18: Echographic variants of adenolymphoma of the submandibular salivary gland of small sizes. Grade 4 vascularization in power Doppler imaging – more than five vessels visible in the mass.

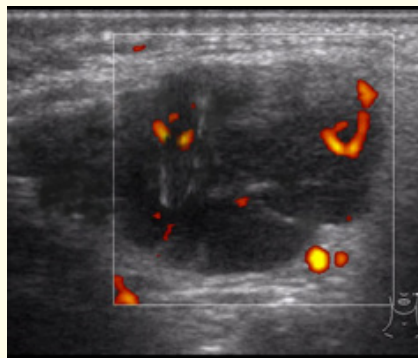


Figure 19: Adenolymphoma of the parotid. Grade 3 vascularization in power Doppler imaging – up to five vessels visible in the mass.

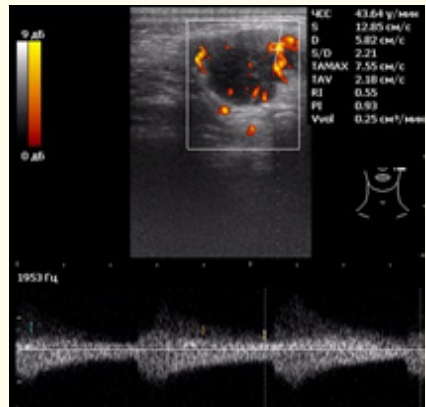


Figure 20: Registration of arterial blood flow along the periphery of the adenolymphoma of the parotid of small sizes.

A third of malignant tumors have an indolent nature and may be clinically indistinguishable from benign lesions. Open biopsy is not encouraged in apparently benign lesions as it carries a theoretical risk of seeding, but it sometimes has a role in the frankly malignant lesion (open or core biopsy) especially when radical surgery is being contemplated. As indolent lesions may masquerade as benign lumps the definitive histology sometimes may not be available until after surgical resection. Diagnosis and management of these tumors is therefore based on the clinical presentation, imaging and cytology and/or histology results. This can distinguish malignant from benign disease in 90 per cent of cases [10].

Most of the malignant tumors of the salivary glands are represented by a slightly differentiated epithelial tissue. Clinically, they are manifested by the presence of a fixed, dense tumor upon palpation. One of the indirect signs of malignancy in the salivary gland is a pathologically altered lymph node on the same side and paresis of the facial nerve.

Specificity of ultrasound symptoms of malignancy of tumor formation is not high. The major part is represented by large lymphoma consisting of several fluid cavities with necrotic or hemorrhagic contents. Echographically, lymphomas are characterized by a high degree of heterogeneity of the parenchyma, irregular shape, uneven contour, fuzzy edges, hypo-anechoic heterogeneous structure, presence of blood flow in anechogenous areas. Small tumors on echographic signs are no different from benign, have a homogeneous structure, an even contour. In such cases, only a comprehensive clinical-ultrasound evaluation will help to conduct differential diagnosis. With the same signs in the B-mode ultrasound, the presence of thick color vascular signals in the central regions of masses, increases the probability of its malignancy to 95 - 98% (Figure 21-23).

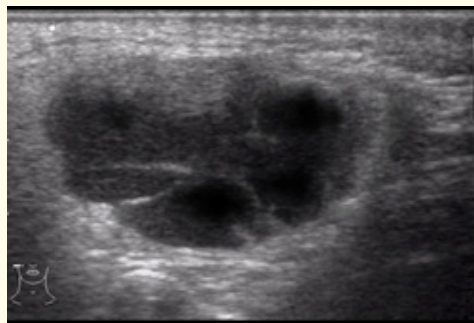


Figure 21: Lymphoma of the parotid. Sonographic image shows a large sizes irregular shape mass, decreased echogenicity, heterogenic structure with anechoic cavity.

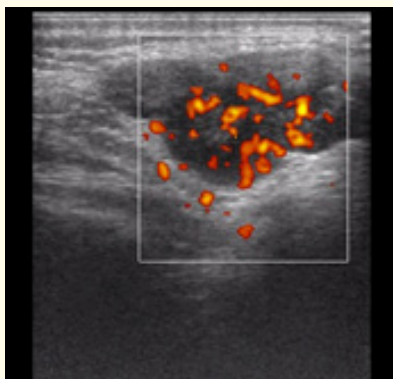


Figure 22: Lymphoma of the parotid. Grade 4 vascularization in power Doppler imaging – multiple vessels visible in the mass.

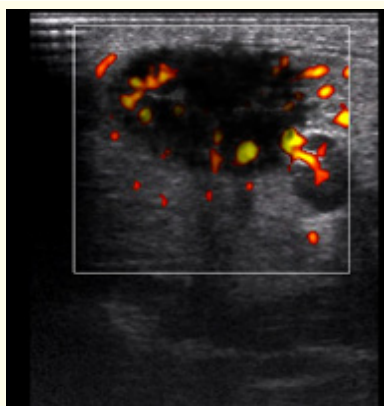


Figure 23: Lymphoma of the parotid. Grade 4 vascularization in power Doppler imaging – multiple vessels visible in the center and periphery of the tumor.

Salivary gland tumors have very wide histological heterogeneity, thus making it difficult to generate high level evidence. Sood S and co-authors (2016) on the assessment and management of patients with cancer originating from the salivary glands in the head and neck are recommends [15]:

- 1) Conduct ultrasound point aspiration cytology for all saliva tumors, which should be evaluated by an expert histopathologist [14];
- 2) After surgery, perform adjuvant radiation therapy for all malignant submandibular tumors, except for cases of small, low-grade tumors that have been completely excised;
- 3) For benign parotid tumors complete excision of the tumour should be performed and offers good cure rates;
- 4) As a general principle, if the facial nerve function is normal pre-operatively then every attempt to preserve facial nerve function should be made during parotidectomy and if the facial nerve is divided intra-operatively then immediate microsurgical repair (with an interposition nerve graft if required) should be considered;
- 5) Neck dissection is necessary in all cases of malignant parotid tumors except for low-grade small tumors;
- 6) Where malignant parotid tumors lie in close proximity to the facial nerve there should be a low threshold for adjuvant radiation therapy;

- 7) Adjuvant radiation therapy should be considered in high grade or large tumours or in cases where there is incomplete or close resection margin;
- 8) Adjuvant radiation therapy should be prescribed on the basis of clinical factors in addition to histology and grade, e.g. stage, pre-operative facial weakness, positive margins, peri-neural invasion and extracapsular spread.

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