Zeszyty Naukowe
Państwowy Instytut Medyczny MSWiA

Praktyka Kliniczna

REVIEW PAPER

e-ISSN 2956-8005
Zeszyty Naukowe PIM MSWiA; 4/2023
doi: 10.53266/ZNPIM-00021-2023-01

Salivary Glands Imaging

Obrazowanie gruczołów ślinowych

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Finansowanie: Brak
Konflikt interesów: Nie zgłoszono

Abstract

Key words: *salivary gland, biopsy, fine-needle, diagnostic imaging*

Introduction and objective: The salivary glands can be categorized into major and minor. This article focuses on the main salivary glands, namely the three paired salivary glands, including the parotid, submandibular and sublingual. The most common salivary gland lesions encountered by radiologists are inflammation (sialadenitis), duct stones (sialolithiasis) and ductal dilatation (sialectasis). The aim of this paper is to briefly summarise the diagnostic imaging options for salivary glands, ensuring that patient management is both appropriate and systematic.

What's already known about this topic? While the issue is well-recognized in selected specialties, it is crucial to disseminate this knowledge across all medical disciplines and encourage interdisciplinary treatment approaches.

Abstract: Benign tumors most often affect the parotid gland, and 50% of them affect the submandibular gland. Following the principle that the smaller the gland, the greater the risk of malignancy - cancer lesions in the sublingual salivary glands and small salivary glands are usually malignant. It is essential to note that there are thousands of small salivary glands in the mucous membrane of the mouth and throat. The diagnostic assessment of nodular lesions of the salivary glands is based on radiological and clinical criteria, and the best and most accessible way to make the diagnosis is FNAC or CNB examination supported by ultrasound planning. In addition to the well-established role of ultrasound, in questionable cases it may be necessary to perform cross-sectional imaging tests to obtain a more accurate diagnosis in terms of location, size, topography of the lesion and potential vascular or nerve infiltration, which will enable the selection of the most appropriate surgical treatment.

Streszczenie

Słowa kluczowe: *gruczoł ślinowy, diagnostyka obrazowa, biopsja cienkoigłowa*

Wprowadzenie i cel: Ślinianki można podzielić na główne i mniejsze. Niniejszy artykuł koncentruje się na głównych gruczołach ślinowych, którymi są trzy sparowane gruczoły ślinowe, w tym ślinianka przyuszna, podżuchwowa i podjęzykowa. Najczęstsze zmiany w gruczołach ślinowych napotykane przez radiologów to zapalenie (sialadenitis), kamienie przewodowe (sialolithiasis) i poszerzenie przewodów (sialectasis). Celem niniejszego artykułu jest krótkie podsumowanie opcji diagnostyki obrazowej gruczołów ślinowych, tak aby postępowanie z pacjentem było odpowiednie i ustrukturyzowane.

Skrócony opis stanu wiedzy: Zagadnienie to jest z pewnością znane w wybranych specjalnościach, ale powinno być również rozpowszechniane wśród wszystkich specjalności medycznych i traktowane interdyscyplinarnie..

Streszczenie: Nowotwory łagodne najczęściej dotykają ślinianki przyusznej, a 50% z nich ślinianki podżuchwowej. Zgodnie z zasadą, że im mniejszy gruczoł, tym większe ryzyko złośliwości - zmiany nowotworowe w śliniance podjęzykowej i małych gruczołach ślinowych są zazwyczaj złośliwe. Należy pamiętać, że w błonie śluzowej jamy ustnej i gardła znajdują się tysiące małych gruczołów ślinowych. Ocena diagnostyczna zmian guzkowych ślinianek opiera się na kryteriach radiologicznych i klinicznych, a najlepszym i najbardziej dostępnym sposobem postawienia diagnozy jest badanie FNAC lub CNB wsparte planowaniem ultrasonograficznym. Oprócz ugruntowanej roli USG, w wątpliwych przypadkach może być konieczne wykonanie przekrojowych badań obrazowych w celu uzyskania dokładniejszej diagnozy pod względem lokalizacji, wielkości, topografii zmiany i potencjalnego naciekania naczyń lub nerwów, co umożliwi wybór najbardziej odpowiedniego leczenia chirurgicznego.

Abbreviations

CT - Computed Tomography
MRI - Magnetic Resonance Imaging
US – Ultrasonography
SGT - Salivary gland tumors
FNAC - Fine-needle aspiration cytology

Otrzymano: 29.09.2023
Zaakceptowano: 22.12.2023
Opublikowano: 22.12.2023

Introduction

The salivary glands can be categorized into major and minor. This article focuses on the main salivary glands, namely the three paired salivary glands, including the parotid, submandibular and sublingual. The most common salivary gland lesions encountered by radiologists are inflammation (sialadenitis) (fig. 1), duct stones (sialolithiasis) (fig. 2) and ductal dilatation (sialectasis) (fig. 3). Benign tumors most often affect the parotid gland and 50% affect the submandibular gland. Following the principle that the smaller the gland, the greater the chance of malignancy - cancer lesions in the sublingual glands and small salivary glands are usually malignant. It should be remembered that in the mucous membrane of the mouth and throat there are thousands of small salivary glands, they have a diameter of 1-2 mm and, unlike the main salivary glands, they do not have a capsule [1]. Tumors of the minor salivary glands account for approximately 15% of all salivary gland tumors. However, tumors originating from them are usually less aggressive than tumors of large salivary glands [2].

Imaging modalities

Imaging modalities such as ultrasound, CT, MRI and sialography are available for salivary glands imaging. Classical sialography and CT sialography techniques tend to be superseded by non-invasive MRI sialography. It is a rather sensitive and reliable method of assessing the salivary glands, T2-weighted sequences with fast acquisition illuminate the intramucosal fluid and adequately visualize the morphology of the ducts without the need to inject contrast into the ducts. Therefore, the following sections present non-invasive methods.

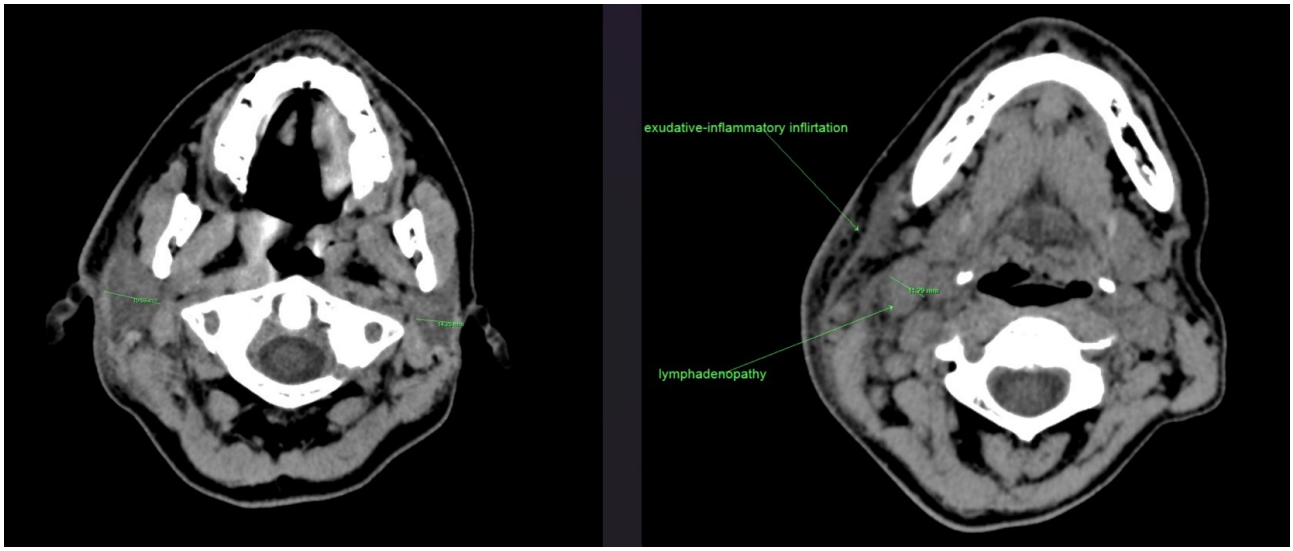

Figure 1 *Images of salivary gland inflammation (sialadenitis) on CT scan without administration of contrast agent. Asymmetric enlargement of the right parotid gland, increased density of the surrounding subcutaneous tissue in the presence of exudative-inflammatory strands and localised lymphadenopaty can be seen.*

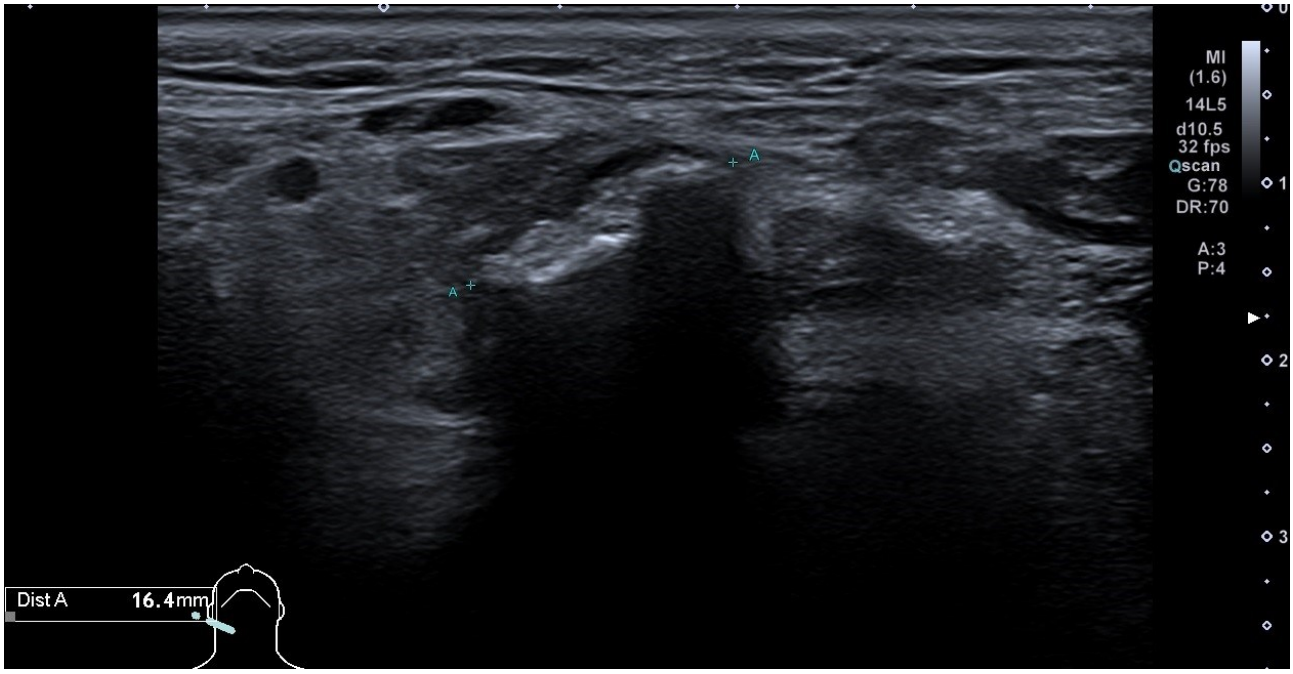

Figure 2 *Hyperechoic reflection seen on ultrasound caused by a deposit in the parotid duct (sialolithiasis).*

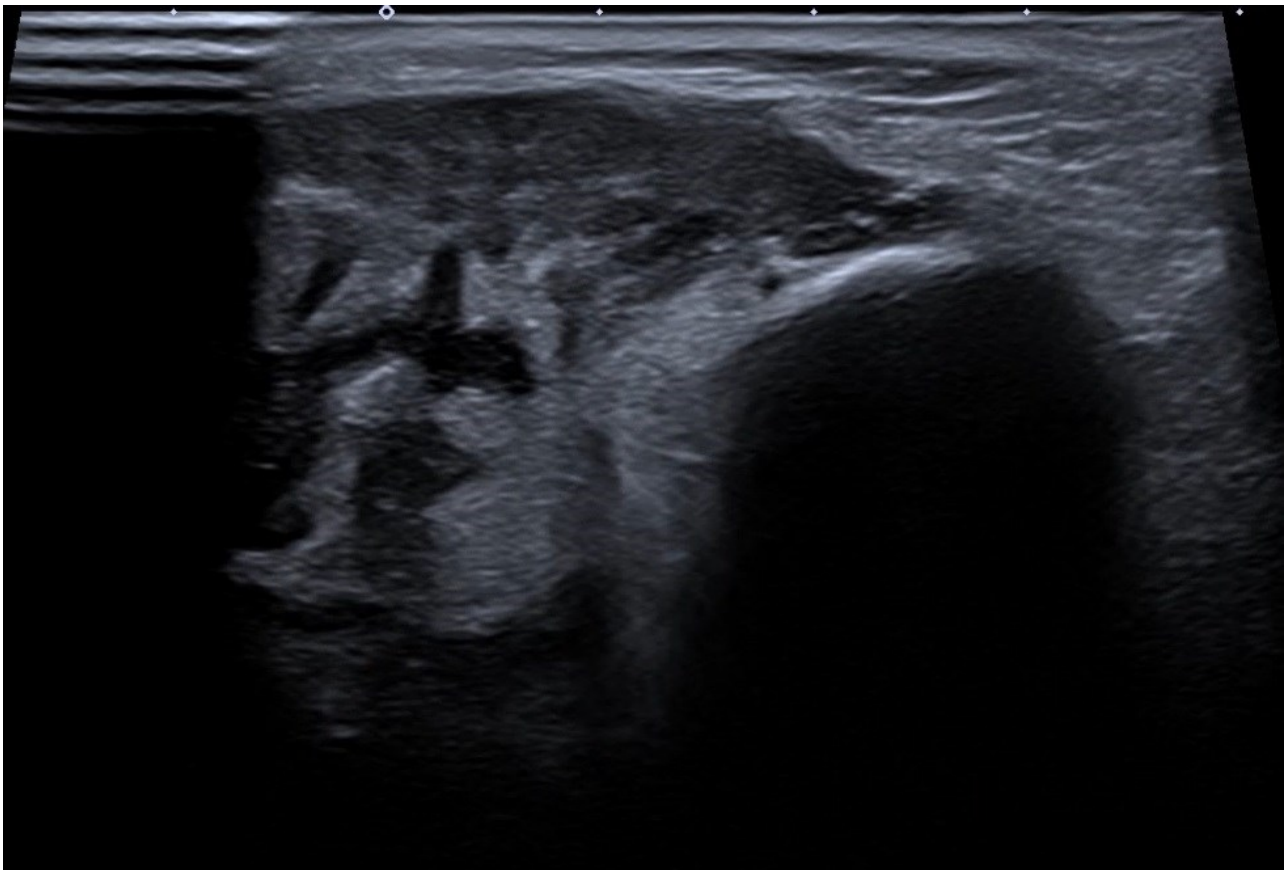

Figure 3 *Ultrasound image of ductal dilatation secondary to lithiasis (sialectasis).*

First step towards diagnosis

Following the clinical examination stage, which identifies abnormalities in the main salivary glands, the imaging diagnosis should start with ultrasonography. According to Ying Liu et al, early studies in which the diagnostic criteria remained mostly consistent in each detection procedure showed that US had high sensitivity. With the new index used in the detection procedure, diagnostic results varied considerably. For example, color Doppler flow imaging is an important tool for differentiating lesions and making a sufficiently confident diagnosis however, blood flow information was not able to predict significant differences between benign and malignant SGT. The specificity of ultrasound is generally good, as most SGTs are benign with only a small percentage being malignant (9.5%). During the ultrasound diagnostic procedure for patients with SGTs, some features such as lesion size, echogenicity, margin regularity and vascularization (fig. 4) should be considered; in addition, clinical data such as medical history, growth rate, pain and facial palsy should also be taken into account. In some cases, such as a large mass in the deep lobe of the salivary gland, differential diagnosis becomes challenging using ultrasound. In such cases, complementary imaging studies such as CT and MRI, which are commonly employed, may provide valuable assistance [3]. It's important to note that US examination is also a valuable and cost-effective tool for assessing the lymph nodes in the neck. This is helpful in differentiating between benign and potentially malignant tumors.

Overview of CT and MRI imaging

Computed tomography is a fast and cost-effective examination with images of sufficient contrast resolution. It allows an assessment of parotid lesions, with diagnosis of location, size, margins and density, the presence of intramural calcifications, invasion of surrounding tissues and infiltration of bony or cartilaginous structures. The main limitation of CT remains its exposure to radiation [4].

In contrast, MRI is a non-radiation-intensive imaging modality that can provide higher sensitivity and specificity values for morphological and volumetric assessment, lesion components, extravascular extension and perivascular spread. Nevertheless, in some cases, the high cost and prolonged scanning time may discourage its use, and similar features and conflicting results have been shown in different studies when differentiating benign and malignant nodules. Therefore, it can be considered a helpful tool, but insufficient for definitive characterization [4].

Unfortunately, neither method has demonstrated achieving the ideal AUC value obtained with ultrasound. However, the advantages of CT and MRI are significant and continue to play an important role in cancer management. Despite this study found no significant difference in diagnostic accuracy between benign and malignant SGTs, CT or MRI is the recommended method of investigation in SGT patients with clinical

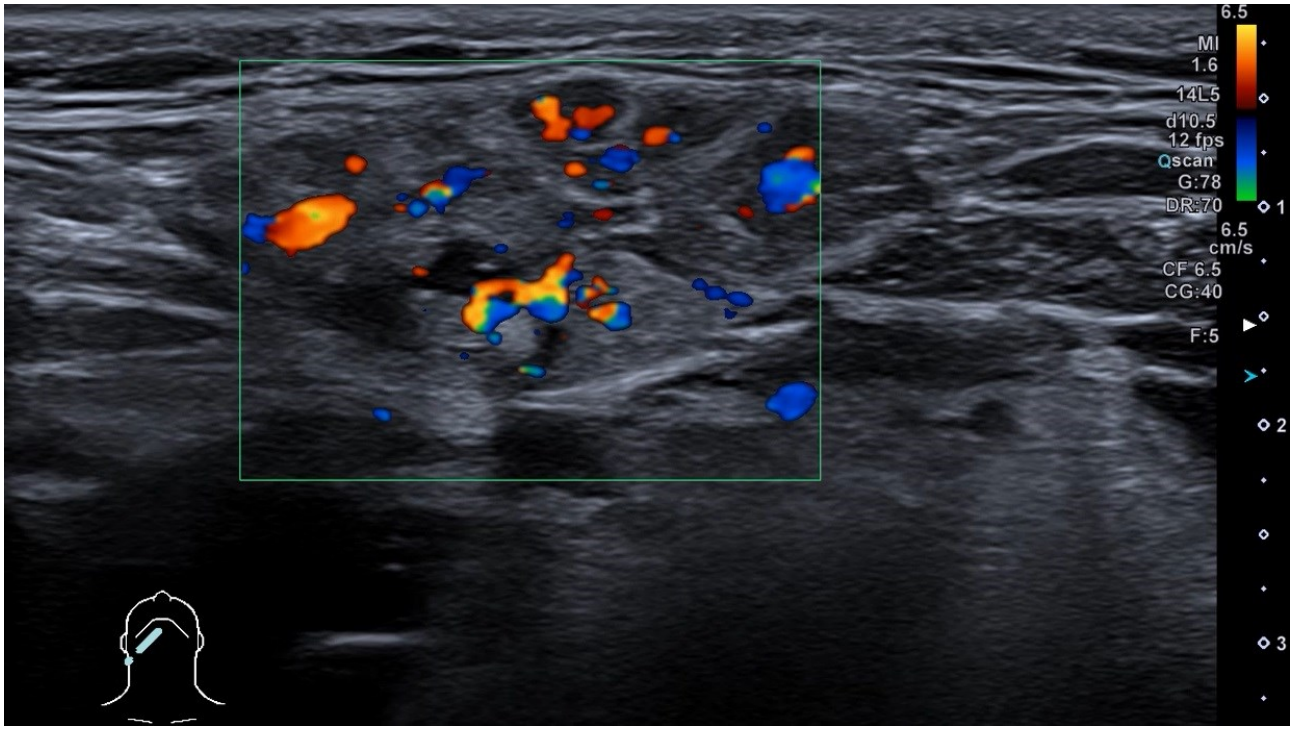

Figure 4 *Color doppler ultrasonographic image of increased blood flow (hypervascularisation) in the salivary gland in the setting of inflammation.*

symptoms such as pain, rapid growth and facial paralysis. As CT and MRI have good sensitivity, they provide useful anatomical information for surgeons and for planning non-surgical treatment. It should be added that this imaging is repeatable and can be used to evaluate surgical and combined treatment [3].

Approach to Focal Lesions

The diagnostic evaluation of a nodular lesion of the parotid gland is based on both radiological and clinical criteria, with fine-needle aspiration cytology or histological core biopsy still the best and easiest method available for making a diagnosis. Simultaneously, ultrasonography remains the first imaging modality to be reached for when biposies are planned. However, in addition to the well-established role of sonography, in doubtful cases cross-sectional imaging may be necessary to obtain a more accurate diagnosis concerning the location, size and topography of the lesion, thus enabling the selection of the most appropriate surgical treatment [4]. Conversely, a notable association between inflammation and false-positive fine-needle biopsy results has been documented both by the Seifert et al. in the source reproduced below and during the author's practice. Squamous cells arising from foci of benign squamous metaplasia are occasionally observed in aspirates from chronic sialadenitis, but rarely have a troublesome morphology. More concerning are the bizarre metaplastic lesions that can occur as a result of irradiation or in necrotizing sialometaplasia. The latter is rare and virtually confined to the palate, but is a recognized potential source of a histological false-positive malignancy report and thus, it must be considered a similar problem in cytological samples. Post-irradiation parotitis is a rarer difficulty, and although knowing the history of irradiation is helpful, the treatment for malignant tumor was administered in the first place. Bizarre squamous cell lesions can still present a diagnostic dilemma. The possibility of misdiagnosis of squamous cell carcinoma was noted by Seifert et al. in their review of Warthin's tumor histology and at least one case was documented in which a false-positive diagnosis of FNAC occurred [5]. Following Prof. Ścierski and coworkers, aspiration biopsy is advocated for every patient with a parotid salivary gland tumor. The risk of spreading potentially cancerous cells during a biopsy is low. In doubtful cases, an ad hoc examination should be performed during surgery and the radicalness of the procedure should depend on it [6].

Conclusions

The diagnostic evaluation of a salivary gland nodular lesion is based on both radiological and clinical criteria, with FNAC or CNB supported by ultrasound in their planning still the best and most easily accessible method for establishing a diagnosis. In this process, it is important to take into account inflammatory factors that may cause false-positive results of aspirates taken. In addition to the well-established role of sonography, in doubtful cases cross-sectional imaging may be necessary to obtain a more accurate diagnosis regarding the location, size, topography of the lesion and the potential invasion of vessels or nerves, which will enable the selection of the most appropriate surgical treatment [4].

References

1. Koenig LJ et al. Diagnostic Imaging: Oral and Maxillofacial, 2nd ed. Elsevier, 2017
2. Ahuja AT. Diagnostic Ultrasound: Head and Neck. Amirsys, 2014
3. Liu Y, Li J, Tan YR, Xiong P, Zhong LP. Accuracy of diagnosis of salivary gland tumors with the use of ultrasonography, computed tomography, and magnetic resonance imaging: a meta-analysis. Oral Surg Oral Med Oral Pathol Oral Radiol. 2015 Feb;119(2):238-245.e2. doi: 10.1016/j.oooo.2014.10.020. Epub 2014 Nov 14. PMID: 25577417.
4. Cicero G, D'angelo T, Racchiusa S, Salamone I, Visalli C, Bottari A, Blandino A, Mazziotti S. Cross-sectional Imaging of Parotid Gland Nodules: A Brief Practical Guide. J Clin Imaging Sci. 2018 Apr 16;8:14. doi: 10.4103/jcis.JCIS_8_18. PMID: 29770262; PMCID: PMC5939036.
5. Young JA. Diagnostic problems in fine needle aspiration cytopathology of the salivary glands. J Clin Pathol. 1994 Mar;47(3):193-8. doi: 10.1136/jcp.47.3.193. PMID: 8163687; PMCID: PMC501893.
6. Ścierski W. et al. DIAGNOSTICS AND TREATMENT OF PAROTID GLAND TUMORS, Mag. ORL, 2021, 79, XX, 108–113