Yonago Acta Medica 2020;63(1):42–46 doi: 10.33160/yam.2020.02.006

Impact of Screening for Salivary Gland by Ultrasonography

Kanna Onda,* Takahiro Fukuhara,† Eriko Matsuda,† Ryohei Donishi,† Yasuaki Hirooka,‡ Hiromi Takeuchi† and Masahiko Kato*

**Department of Pathobiological Science and Technology, School of Health Science, Tottori University Faculty of Medicine, Yonago 683-8503, Japan, †Division of Otolaryngology, Head and Neck Surgery, Department of Sensory and Motor Organs, School of Medicine, Tottori University Faculty of Medicine, Yonago 683-8504, Japan, and ‡Department of Surgery, Tottori Prefectural Central Hospital, Tottori 680-0901, Japan*

ABSTRACT

Background Ultrasonography is superior to other imaging modalities for detecting salivary gland diseases. However, there have been no reports of the results of salivary gland screening with ultrasonography. In this study, the salivary glands were also observed during thyroid ultrasonography to determine the degree of salivary gland abnormalities detected by ultrasonography.

Methods This study was conducted retrospectively using medical records. It assessed the association between the following abnormal findings detected during thyroid ultrasonography and their final diagnoses: atrophy/swelling, unclear demarcation from surrounding tissues, decreased salivary gland parenchyma echo level, heterogeneity of parenchyma, hypervascularity of salivary gland parenchyma, dilatation of the ducts, and a mass within the gland.

Results Of the 908 patients who underwent thyroid ultrasonography, salivary gland abnormalities were detected in 36 (4.0%) patients. Of the 36 patients with abnormal ultrasonographic findings, 22 underwent further examination. Of the 22 patients, 16 received definitive diagnoses of salivary gland diseases.

Salivary gland disorders were considered to be absent in patients with only heterogeneity of the salivary glands observed on ultrasonography. Salivary gland disorders in all patients with further abnormal ultrasonographic findings such as atrophy/swelling, unclear boundary, or hypervascularity in addition to internal heterogeneity were confirmed by further blood examinations and imaging studies. We were able to detect autoimmune sialadenitis such as Sjögren's syndrome and IgG4-related sialadenitis by ultrasonography in patients without obvious symptoms.

Conclusion Salivary gland screening during thyroid ultrasonography revealed abnormal findings including Sjögren's syndrome and IgG4-related sialadenitis in about 4% of the patients. Thus, ultrasonography may also be useful for early detection of autoimmune diseases of salivary glands.

Key words alivary gland; sialadenitis; Sjögren's syndrome; thyroid; ultrasonography

Minor abnormalities of the salivary glands are difficult to detect using computed tomography or magnetic resonance imaging and asymptomatic lesions are rarely detected incidentally. On the other hand, ultrasonography can scan the salivary glands in detail and detect minor salivary gland abnormalities,[1, 2] and can be recommended as the initial imaging modality for salivary gland tumors.[3]

However, few hospitals perform ultrasonography for the whole neck, including the salivary glands during thyroid ultrasonography, although thyroid ultrasonography is part of the routine work-up at several hospitals. We perform whole-neck scanning for patients undergoing thyroid gland examination in our department. Ultrasonography is performed for the submandibular and parotid glands, even if there are no abnormal findings or lesions in the salivary glands.[4] Therefore, salivary gland abnormalities may be detected incidentally on thyroid ultrasonography.

The aim of this study was to determine the frequency of detection of salivary gland abnormalities on thyroid ultrasonography by retrospectively reviewing the medical records. Furthermore, we retrospectively investigated the abnormal ultrasonographic findings of the salivary glands detected by thyroid ultrasonography and their diagnoses.

SUBJECTS AND METHODS

Patients

This study was approved by the Institutional Review Board of Tottori University (Approval No. 19A122) and was performed in accordance with the Declaration of Helsinki.

The participants included 908 consecutive patients who underwent salivary gland evaluation during thyroid ultrasonography at the department of Otolaryngology, Head and Neck Surgery, Tottori University between July 2016 and July 2019.

Corresponding author: Takahiro Fukuhara, MD, PhD
tfukuhara3387@tottori-u.ac.jp
Received 2019 November 26
Accepted 2020 January 6
Online published 2020 January 30

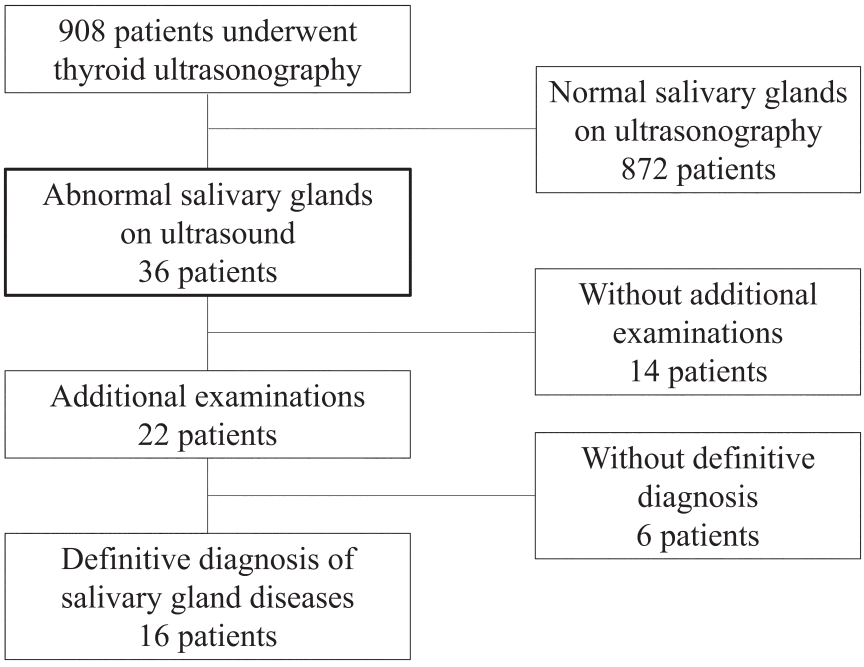

Fig. 1. Flowchart of the patients involved in this study.

Ultrasonography machines

We used an Acuson S2000 ultrasound system with a 14L5 (5–14 MHz) and 9L4 (4–9 MHz) linear transducer (Siemens Medical Solutions, CA) and Arietta E70 with an L441 (2–12 MHz) linear transducer (Hitachi Healthcare, Tokyo, Japan).

Examination procedures

All patients were scanned in the supine position with their necks slightly extended. The ultrasound examinations were performed according to established procedure, by two head and neck surgeons and two sonographers with over 5 years of experience in performing these procedures.[1] The procedure involved scanning the thyroid gland first, followed by the lymph nodes along the internal jugular vein and finally, the submandibular and parotid glands.

Criteria

Atrophy/swelling, unclear demarcation from the surrounding tissues, decreased salivary gland parenchyma echo level, heterogeneity of parenchyma, hypervascularity of salivary gland parenchyma, dilatation of the ducts, and tumor within the gland were defined as abnormal findings of the submandibular and parotid glands.[5–7]

Reviewing the images and the diagnoses

All the ultrasonographic reports and stored images were reviewed by two head and neck surgeons and two sonographers. Only the first documented findings of salivary gland abnormalities were evaluated in patients who underwent more than one round of ultrasound examination during the study period. We retrospectively searched the medical records for the diagnoses of patients with the abnormal ultrasonographic findings mentioned above.

RESULTS

Of the 908 patients who underwent thyroid ultrasonography, salivary gland abnormalities were detected in 36 patients. Of the 36 patients with abnormal ultrasonography findings, 22 underwent additional examination. Of the 22 patients, 16 received definitive diagnoses of salivary gland diseases (Fig. 1).

The characteristics of 36 patients with salivary gland abnormalities detected on ultrasound are shown in Table 1. The participants included 10 men (27.8%) and 26 women (72.2%) and the mean age was 64.8 years. The types of the thyroid disease affecting the 36 patients is also shown in Table 1. Two patients (5.6%) had no thyroid disease.

The breakdown of the abnormal findings detected by ultrasonography in the 36 patients is shown in Fig. 2. Fourteen patients of the 36 patients with abnormal ultrasound findings did not receive further examinations; one patient received treatment for another disorder first, and the other 13 patients did not wish to undergo additional

Table 1. Basic characteristics of patients

Patients	*n* = 36
Sex (Male/Female)	10/26
Age (mean ± SD)	64.8 ± 14.8 years
Breakdown of thyroid disease	
Nodular hyperplasia	10 (27.7%)
Postoperative thyroid carcinoma	10 (27.7%)
Hashimoto's thyroiditis	4 (11.1%)
Papillary thyroid carcinoma	4 (11.1%)
Nodular hyperplasia + Hashimoto's thyroiditis	1 (2.8%)
Cyst	1 (2.8%)
Papillary thyroid carcinoma + Nodular hyperplasia	1 (2.8%)
Folicular tumor	1 (2.8%)
Basedow disease	1 (2.8%)
Painless thyroiditis	1 (2.8%)
No findings	2 (5.6%)

examination because of their advanced age (average age of 13 patients: 74.2 years) and were asymptomatic.

The salivary gland disorders in all patients with abnormal ultrasonographic findings such as atrophy/swelling, unclear boundaries, or hypervascularity in addition to internal heterogeneity were confirmed by further blood examinations and imaging studies.

Patients with salivary gland tumors detected on ultrasonography underwent fine needle aspiration cytology.

Six patients with only heterogeneity of the salivary glands underwent additional blood examinations and as a result, none of the patients had abnormal autoantibody or amylase levels. Therefore, salivary gland disorders were thought to be absent in these patients. Their average age was 45.8 years.

The details of the salivary gland disorders of 16 patients were as follows: 4 patients had of Sjögren's syndrome, 1 patient had IgG4 related sialadenitis, 1 patient had parotid gland hypoplasia, 3 had postoperative sialadenitis, 1 had malignant lymphoma, 3 had benign tumors, 2 had intraglandular swelling in the lymph nodes, and 1 had salivary calculi.

DISCUSSION

There are few reports of salivary gland diseases discovered incidentally during thyroid ultrasonography. Of the 908 patients who underwent thyroid ultrasonography in this study, salivary glands abnormalities were detected in 36 patients on ultrasonography, which was 4.0% of the total study population.

There is no association between thyroid disease and salivary gland disease except for conditions such as Hashimoto's disease and autoimmune sialadenitis.[8] The thyroid disorders affecting the participants of this study included several nodular diseases, but autoimmune thyroid diseases such as Hashimoto's thyroiditis were uncommon at 14% (128/908), because head and neck surgeons perform surgery primarily to treat thyroid disease. In this study, only one of five patients with autoimmune salivary gland diseases (four patients with Sjögren's syndrome and one with IgG4 related sialadenitis) also had Hashimoto's disease. In this study, many patients who were targeted for thyroid ultrasonography were aimed at examining and following nodular lesions for which surgery is indicated in otolaryngology and head and neck surgery. On the other hand, the disease that is the subject of medical treatment is the major concern in endocrinology. Thus endocrinologists are more likely to detect autoimmune thyroid diseases such as Hashimoto's thyroiditis on thyroid ultrasonography, it was thought that the probability of detecting autoimmune salivary gland disorders would be higher on salivary gland ultrasonography.

Patients with only heterogeneity of the salivary glands were thought to be free of salivary gland disorders. On the other hand, salivary gland disorders were confirmed in all patients with further abnormal ultrasonographic findings such as atrophy/swelling, unclear boundaries, or hypervascularity in addition to internal heterogeneity. The mean age of the patients with only heterogeneity was 45.8 years. They were too young to

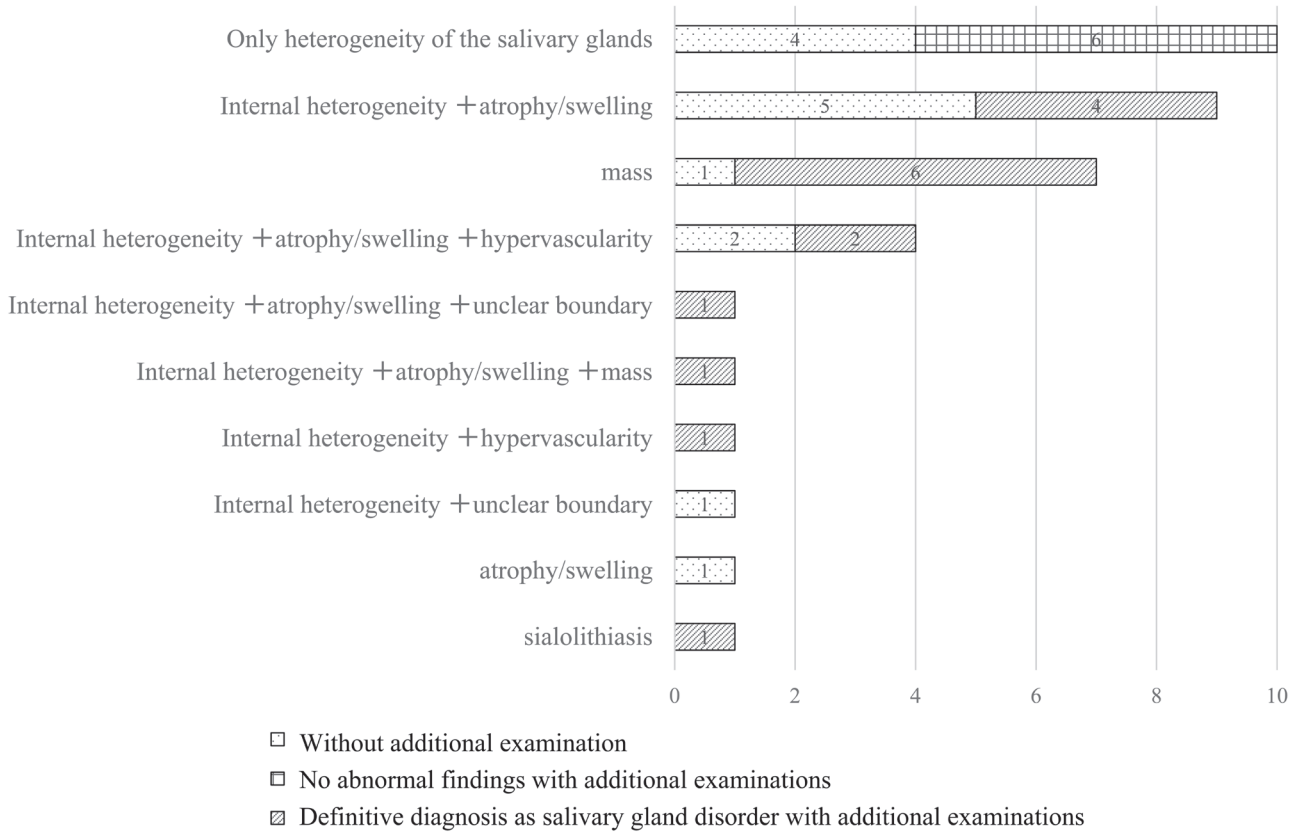

Fig. 2. The breakdown of the abnormal findings detected by ultrasonography for 36 patients Salivary gland disorders were confirmed in all patients with further abnormal ultrasonographic findings such as atrophy/swelling, unclear boundaries, or hypervascularity in addition to internal heterogeneity.

develop chronic sialadenitis. Thus, the abnormal finding of parenchymal heterogeneity in the salivary gland may be more indicative of autoimmune sialoadenitis at an early stage, in which blood investigations failed to demonstrate any abnormalities other than changes due to chronic sialadenitis. There have been reports of patients with IgG4-related sialadenitis, in whom the serum IgG4 levels did not meet the diagnostic criteria, even when the salivary glands appeared abnormal on ultrasonography.[9, 10]

In this study, we were able to detect salivary gland diseases such as Sjögren's syndrome and IgG4-related sialadenitis by ultrasonography. Since minor changes in the salivary glands cannot be detected by computed tomography or magnetic resonance imaging,[11, 12] they are unlikely to be detected incidentally in patients who do not present with prominent symptoms. IgG4-related sialadenitis and Sjögren's syndrome, which often coexist with other systemic or autoimmune disorders, are difficult to diagnose till the development of symptoms. However, the former causes irreversible fibrosis of the tissues as the disease progresses, and the latter causes serious symptoms as the disease develops.[13, 14] Therefore, careful follow-up is necessary even if the patient is asymptomatic, and early detection and treatment of these diseases are vital. The salivary glands are superficial and can easily be visualized on ultrasonography. Therefore, it is worthwhile to examine the salivary glands during thyroid ultrasonography. However, the frequency and duration of follow-up for a patient suspected of autoimmune sialadenitis on ultrasonography needs to be investigated.

The salivary glands are superficial and can easily be visualized on ultrasonography. Therefore, it is worthwhile to examine the salivary glands during thyroid ultrasonography. However, the frequency and duration of follow-up for a patient suspected of autoimmune sialadenitis on ultrasonography needs to be investigated.

We realize that this study had some limitations. First, the study design was retrospective and was based on medical records. Therefore, the course of the abnormal salivary gland findings detected by ultrasonography remains unclear. Second, some patients with salivary gland abnormalities detected on ultrasonography did not

undergo further examinations. Third, the ultrasonography findings of the salivary glands may be influenced by individual differences and age, and the relationship between the abnormal ultrasound findings and the disease is unclear.

In conclusion, salivary glands screening during thyroid ultrasonography revealed abnormal findings in about 4% of patients. These patients included Sjögren's syndrome and IgG4-related sialadenitis. Ultrasonography may also be useful for the early detection of autoimmune salivary gland diseases.

The authors declare no conflict of interest.

REFERENCES

1 Shimizu M, Okamura K, Kise Y, Takeshita Y, Furuhashi H, Weerawanich W, et al. Effectiveness of imaging modalities for screening IgG4-related dacryoadenitis and sialadenitis (Mikulicz's disease) and for differentiating it from Sjögren's syndrome (SS), with an emphasis on sonography. Arthritis Res Ther. 2015;17:223. DOI: 10.1186/s13075-015-0751-x, PMID: 26298875

2 Ohnishi T, Tanaka L, Sano T, Sano T, Hosokawa Y, Kaneko M. Ultrasonographic features and vascular patterns of the submandibular gland. Higashi Nippon Dental Journal. 2004;23:1-6.

3 Matsuda E, Fukuhara T, Donishi R, Kawamoto K, Hirooka Y, Takeuchi H. Usefulness of a Novel Ultrasonographic Classification Based on Anechoic Area Patterns for Differentiating Warthin Tumors from Pleomorphic Adenomas of the Parotid Gland. Yonago Acta Med. 2017;60:220-6. DOI: 10.33160/yam.2017.12.002, PMID: 29434491

4 Furukawa M. Ultrasonography for the head and neck area. Nihon Chouonpa Igakukai shi. 2018;45:279-86. DOI: 10.3179/jjmu.JJMU.R.129. Japanese with English abstract.

5 Zajkowski P, Ochal-Choińska A. Standards for the assessment of salivary glands - an update. J Ultrason. 2016;16:175-90. DOI: 10.15557/JoU.2016.0019, PMID: 27446602

6 Howlett DC, Alyas F, Wong KT, Lewis K, Williams M, Moody AB, et al. Sonographic assessment of the submandibular space. Clin Radiol. 2004;59:1070-8. DOI: 10.1016/j.crad.2004.06.025, PMID: 15556589

7 Yuasa K. Diagnostic imaging for salivary gland disease. Nihon Koku Geka Gakkai Zasshi. 2011;8:434-40. Japanese with English abstract.

8 Sierra Santos L, Sendino Revuelta A, Pacheco Cuadros R, Aparicio Jabalquinto G, Barbado Hernández FJ. [Hashimoto's thyroiditis and Sjögren syndrome. Association or autoimmune multiple syndrome?]. Med Interna. 2001;18:86-7. PMID: 11322005. Spanish with English abstract.

9 Inoue D, Yoshida K, Yoneda N, Ozaki K, Matsubara T, Nagai K, et al. IgG4-Related Disease: dataset of 235 consecutive patients. Medicine (Baltimore). 2015;94:e680. DOI: 10.1097/MD.0000000000000680, PMID: 25881845

10 Wallace ZS, Deshpande V, Mattoo H, Mahajan VS, Kulikova M, Pillai S, et al. IgG4-Related Disease: Clinical and Laboratory Features in One Hundred Twenty-Five Patients. Arthritis Rheumatol. 2015;67:2466-75. DOI: 10.1002/art.39205, PMID: 25988916

11 Asai S, Okami K, Nakamura N, Shiraishi S, Yamashita T, Anar D, et al. Sonographic appearance of the submandibular glands in patients with immunoglobulin G4-related disease. J Ultrasound Med. 2012;31:489-93. DOI: 10.7863/jum.2012.31.3.489, PMID: 22368140

12 Fujita A, Sakai O, Chapman MN, Sugimoto H. IgG4-related disease of the head and neck: CT and MR imaging manifestations. Radiographics. 2012;32:1945-58. DOI: 10.1148/rg.327125032, PMID: 23150850

13 Kamisawa T, Zen Y, Pillai S, Stone JH. IgG4-related disease. Lancet. 2015;385:1460-71. DOI: 10.1016/S0140-6736(14)60720-0, PMID: 25481618

14 Takahashi H, Yamamoto M, Shinomura Y, Imai K. Long-term outcomes and necessity of early intervention for IgG4-related disease. Japanese Journal of Clinical Immunology. 2013;36:442-51. DOI: 10.2177/jsci.36.442, PMID: 24390104