

Salivary scintigraphy with vitamin C stimulation: an aid in differentiating unilateral parotitis from Warthin's tumor

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Abstract. Of the nine patients included in this study, five with proven unilateral parotitis initially had diffuse high uptake of ^{99m}Tc-pertechnetate in the affected glands with adequate washout following vitamin C stimulation. Of four patients with proven Warthin's tumor, two had focal high uptake in the parotid masses and two had diffuse high uptake on baseline images. All tumors were clearly delineated after stimulation. ^{99m}Tc-pertechnetate salivary scintigraphy with vitamin C stimulation may provide a useful tool in differentiating unilateral parotitis from Warthin's tumor.

Key words: Salivary scintigraphy – Parotitis – Warthin's tumor

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Introduction

Radionuclide scanning with ^{99m}Tc-pertechnetate has been proved useful in evaluating certain morphologic and functional diseases of the salivary glands (Shall and DiChiro 1972). This test can sometimes help define the nature of salivary gland tumors and their relationship to normal anatomic structures. For example, Warthin's tumors appear "hot" relative to the surrounding tissues, whereas metastatic tumors appear "cold" (Greyson and Noyek 1982). Age and sex of the patient, location of the mass, as well as its appearance on scan are relatively specific for Warthin's tumor. However, unilateral hot lesions are characteristic not only of Warthin's tumor, but also appear in some cases of sialolithiasis and inflammation (Ohrt and Shafer 1982).

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Washout imaging following gustatory stimulation has been used in the diagnosis of Warthin's tumor, though the tumor becomes more apparent on the discharge study (Mishkin 1981; Greyson and Noyek 1982; Higashi 1987). Application of gustatory stimulation to acute parotitis has not been reported previously, and it is still unclear whether there is retention of ^{99m}Tc-pertechnetate in acute parotitis following stimulation; therefore, this study is designed to assess the value of salivary scintigraphy with vitamin C (ascorbic acid) stimulation in differentiating unilateral parotitis from Warthin's tumor.

Materials and methods

The study included nine patients with swelling of parotid glands. Immediately after intravenous injection of 10 mCi ^{99m}Tc-pertechnetate, dynamic scintigraphy was performed in a posterior position every 2 min for the first 10 min and then at 10-min intervals for the next 40 min. After the dynamic study, static images of 200,000 counts in the Water's, right lateral, left lateral, and posterior views were obtained, and subsequently 500 mg ascorbic acid was given sublingually. Five minutes after stimulation, a routine four-view static study of the salivary glands was undertaken.

The final diagnosis of Warthin's tumor was determined by surgery, that of parotitis by laboratory tests.

Results

Of the nine patients, five had unilateral parotitis and four had Warthin's tumor. The unilateral parotitis cases consisted of four acute purulent cases and one epidemic case (mumps). Histopathology of the four Warthin's tumors showed three subtype I cystoadenolymphoma, with a epithelium-to-stroma ratio of 1:1, and one subtype II, with predominant epithelial tumor components. The case with mumps was confirmed by complement-

Table 1. Summary of results of salivary scintigraphy with ascorbic acid stimulation in nine patients

Final diagnosis	Number of patients	Scintigraphic patterns			
		Baseline scintigraphy		Washout imaging after stimulus	
Parotitis	5				
Acute purulent	4	Unilateral diffuse high uptake	5	Normal washout with bilateral equal uptake	4
Mumps	1			Slight stasis on the lesion side	1
Warthin's tumor	4	Unilateral diffuse high uptake	2	Focal high uptake	2
		Focal high uptake	2	More apparent uptake	2

fixation test. Bacterial culture from the four infected glands revealed a growth of *Staphylococcus aureus*. In initial salivary scintigrams, diffuse high uptake of the affected parotid glands occurred in all five patients with parotitis and in two patients with Warthin's tumor; focal high uptake was seen in another two patients with Warthin's tumor. After ascorbic acid stimulation, normal washout with subsequent symmetrical low uptake was observed on both sides in four out of five patients with parotitis; the remaining patient had a slightly global stasis on the affected side only. On the other hand, diffuse uptake in two patients with Warthin's tumor changed to focal high uptake after stimulation, and initial focal high uptake in the other two patients became apparent following stimulation (Table 1).

Figure 1 shows the ^{99m}Tc -pertechnetate salivary scintigrams in representative cases before and after ascorbic acid stimulation. The baseline image in a patient with acute purulent parotitis (upper panel) shows diffusely increased uptake in the left parotid gland. After stimulation, bilateral parotids showed symmetrically low uptake, indicating an adequate washout. The baseline study in a patient with Warthin's tumor (lower panel) showed marked uptake in the inferior portion of the right parotid gland corresponding to the tumor. The washout image showed marked retention of activity in the tumor following stimulation. Another case (middle panel) with Warthin's tumor initially showed diffusely increased uptake in the right parotid gland. Washout imaging clearly delineated a mass with marked retention of radioactivity in the inferior portion of the left parotid gland corresponding to the Warthin's tumor.

Discussion

States associated with the diffuse swelling of salivary gland include parotitis due to a viral (mumps), bacterial,

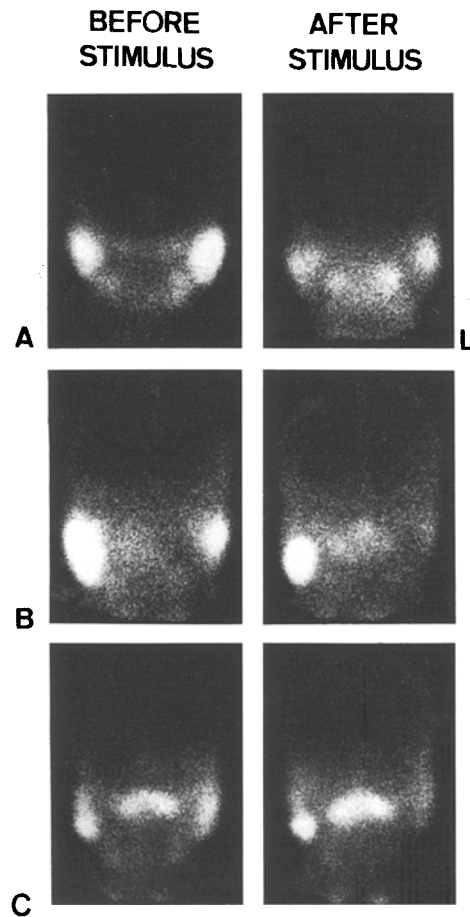


Fig. 1A–C. ^{99m}Tc -pertechnetate salivary scintigrams before and after ascorbic acid stimulation. **A** Unilateral parotitis on the left side: diffuse high uptake in the left parotid gland before stimulation and symmetrical washout on both sides. **B** Warthin's tumor: diffuse high uptake in the right parotid gland before stimulation; focal high uptake in the tumor in the lower portion of the gland after stimulation. **C** Warthin's tumor: focal high uptake which became more apparent after stimulation

toxic, or physical agent, while focal swelling is commonly caused by inflammation, neoplasms, or cysts (Mishkin 1981). In both cases, salivary scintigraphy is very helpful in both diagnosis and treatment (Shall et al. 1981). Aushband et al. (1971) recommended this procedure as part of the routine work-up in patients with a parotid mass. Those glands either showing normal uptake or having a cold nodule contained a tumor, either of the intermediate type such as mixed tumor or mucoepidermoid tumor, or a malignant lesion (Aushband et al. 1971). Unilateral hot lesions are most likely to occur in non-malignant conditions – Warthin's tumor, oncocytoma, or acute sialoadenitis. Therefore, their delineation on scan may alleviate the need for surgery in elderly patients who are not surgical candidates (Gates 1977).

Warthin's tumor, which originates from salivary ductal epithelium, has the capacity to concentrate technetium (Gates and Work 1967). However, there have been reports that ^{99m}Tc -pertechnetate concentrates in both benign and malignant parotid masses, e.g., oncocytoma

(Aushband et al. 1971), mixed tumor, epidermoid carcinoma (McGuirt and McCabe 1977), mucoepidermoid carcinoma (Abramson et al. 1969), acinic cell carcinoma (Dosoretz and Lieberman 1987), or less commonly, lymphoma (Noyek et al. 1982).

In acute parotitis, the marked increase in the uptake of radionuclide by the glands is probably caused by hyperemia and edema fluid that compresses the intralobar ducts. After treatment with antibiotics, the acute suppurative parotitis subsides and the scan returns to normal (Fletcher and Workman 1969; Shall and Di Chiro 1972). However, at the convalescent stage of mumps, the scan shows a decreased or absent uptake of pertechnetate. A similar pattern of diminished pertechnetate uptake is seen in cases of chronic recurrent parotitis after its acute phase (Shall and Di Chiro 1972).

Pilocarpine has been used to increase uptake and excretion of pertechnetate, probably by increasing the flow of saliva (Tarkianen et al. 1970). Administration of perchlorate results in washout of trapped pertechnetate from the ductal epithelium. The thyroid washout study by Holmes (1973) contains similar findings. Several drops of lemon juice or sucking on a lemon have the same effect (Sorsdahl et al. 1969). The washout image is of great importance in the diagnosis of Warthin's tumor because ^{99m}Tc -pertechnetate retention within the tumor is contrasted by the normal gland which drains ^{99m}Tc -pertechnetate after stimulation (Greyson and Noyek 1982; Mishkin 1981). Nevertheless, the washout pattern of acute parotitis has never been reported. Using gustatory stimulation, four of five patients with acute unilateral parotitis had normal washout with subsequent symmetrical low uptake on both parotid glands, and only one patient had a slightly global stasis on the affected side. In contrast, diffuse uptake in two patients with Warthin's tumor changed to focal high uptake following stimulation. In addition, two patients initially having focal high uptake in the Warthin's tumor had clear delineation of the lesion, owing to contrast reinforcement with augmented washout of the normal gland after stimulation. Warthin's tumor does not communicate with the ductal system (Siddiqui and Weisberger 1981), whereas hyperemia and edema do result in the narrowing of intralobar ducts in parotitis. This difference in pathological changes may account for their different responses to gustatory stimulation.

In summary, it may be difficult to differentiate unilateral parotitis from Warthin's tumor with ^{99m}Tc -per-

technetate salivary scintigraphy when the parotid mass has diffuse high uptake; however, washout imaging following gustatory stimulation with ascorbic acid may provide a useful means for their differentiation.

References

- Abramson AL, Levy LM, Goodman M, Attie JN (1969) Salivary gland scintiscanning with Tc-99m pertechnetate. *Laryngoscope* 79:1105
- Aushband JR, Kittrell BJ, Lowen RJ (1971) Radioisotope scanning for parotid oncocytoma. *Arch Otolaryngol Head Neck Surg* 93:628-629
- Dosoretz C, Lieberman LM (1987) Increased uptake of Tc-99m pertechnetate in a salivary gland cancer. *Clin Nucl Med* 12:944-945
- Fletcher MM, Workman JB (1969) Salivary gland scintigram in inflammatory disease. *Am Surg* 35:765-772
- Gates GA (1977) Sialography and scanning of the salivary glands. *Otolaryngol Clin North Am* 10:379-390
- Gates GA, Work WP (1967) Radioisotope scanning of the salivary gland. *Laryngoscope* 77:861-875
- Greyson ND, Noyek AM (1982) Radionuclide salivary scanning. *J Otolaryngol [Suppl]* 10:14
- Higashi T, Murahashi H, Ikuta H, Mori Y, Watanabe Y (1987) Identification of Warthin's tumor with Technetium-99m pertechnetate. *Clin Nucl Med* 12:796-800
- Holmes RA (1973) Potassium perchlorate in salivary gland scintigraphy. *J Nucl Med* 14:409
- McGuirt WF, McCabe BF (1977) Limitations of parotid scans. *Am J Otol* 86:247
- Mishkin FS (1981) Radionuclide salivary gland imaging. *Semin Nucl Med* 11:258-265
- Noyek AM, Greyson ND, Cooter N (1982) Radionuclide salivary gland imaging of maxillary sinus oncocytoma. *J Otolaryngol* 11:17-21
- Ohrt HJ, Shafer RB (1982) An atlas of salivary gland disorders. *Clin Nucl Med* 7:370-376
- Schall GL, Di Chiro G (1972) Clinical usefulness of salivary gland scanning. *Semin Nucl Med* 2:270-277
- Schall GL, Smith RR, Barsocchini LM (1981) Radionuclide salivary imaging - usefulness in a private otolaryngology practice. *Arch Otolaryngol* 107:40-44
- Siddiqui AR, Weisberger EC (1981) Possible explanation of appearance of Warthin's tumor on I-131 and Tc-99m pertechnetate scans. *Clin Nucl Med* 6:258-260
- Sordahl OA, Williams CA, Brano FP (1969) Scintillation camera scanning of the salivary glands. *Radiology* 92:1477-1480
- Tarkianen E, Stjernvall L, Tarkkanen J (1970) Pilocarpine as a diagnostic aid in the scintillography of sialopathies. *Acta Otolaryngol (Stockh)* 70:113-125