EVALUATION OF MAJOR SALIVARY GLAND FUNCTION BY SIALOSCINTIGRAPHY IN NASOPHARYNGEAL CARCINOMA PATIENTS RECEIVING RADIOTHERAPY

Ping-Kun Weng¹, Shyh-Ing Guan², Yee-Min Jen³

¹Department of Otolaryngology, ²Department of Nuclear Medicine, ³Department of Radiation Oncology, Tri-Service General Hospital, National Defense Medical Center

Purpose: To evaluate the major salivary gland functions by sialoscintigraphy in nasopharyngeal carcinoma patients treated by radiotherapy.

Materials and Methods: This analysis includes 28 nasopharyngeal cancer (NPC) patients and 31 sialoscintigraphies. The sialoscintigraphies were grouped as pre-radiotherapy (pre-RT), low dose (< 1050 cGy), and high dose (> 1050 cGy) according to the radiation dose given to the patients when the scanning was performed. Apart from 3 patients who received 2 scannings, the other 26 patients received only one test. Another 8 normal adult sialoscintographies were included as controls. Patients, non-irradiated or irradiated with high or low doses, were given 10 mCi ⁹⁹ᵐTc-pertechnetate and scanned immediately. Twenty minutes later 200 ml of lemon juice was given by mouth and the patient was scanned again for another 20 minutes. Time-activity curves and the cumulative gland ⁹⁹ᵐTc-pertechnetate uptake of each gland were plotted and calculated. The stimulated secretion is defined as: stimulated secretion (SS)=[1-(min/max)]x 100%. The downward slope was also obtained from the post-stimulation curve of the time-activity curve to describe the secretory function.

Results: A strong positive excretion response after lemon juice stimulation of both parotid and submandibular glands was noted in non-irradiated patients. After irradiation of 1050 cGy or less, a significant impairment in secretion of all major salivary glands was noted. The trapping of ⁹⁹ᵐTc-pertechnetate was not affected as compared with the normal controls and pre-RT scanings. After a larger dose of radiations, no curves displayed excretory response after stimulation. In terms of qualitative measurement, the ⁹⁹ᵐTc-pertechnetate uptake is not different among the four groups of patients in either parotid or submandibular glands except in the group after high dose radiations. The down slopes and stimulated secretion are statistically different between the non-irradiated and the irradiated groups.

Conclusion: The salivary gland secretion was totally or partially disturbed in all patients after high dose radiation. Cumulative uptake of ⁹⁹ᵐTc-pertechnetate...
tate after high dose is statistically higher than pre-RT patients. Stimulated secretion was markedly retarded after high dose radiation. The data imply that the mechanism of dry mouth after high dose radiation was mainly excretory dysfunction rather than uptake disturbance of metabolic substances. This observation is valuable in the understanding of the underlying mechanism of radiation-induced salivary gland dysfunction, and may contribute to the future resolution of this difficult side effect.

[Therapeut Radiol Oncol 1997: 4: 57-63]

Key words: sialoscintigraphy, salivary gland, nasopharyngeal cancer, radiotherapy

INTRODUCTION

Nasopharyngeal cancer (NPC) is a common cancer in Taiwan. Radiotherapy has been the main treatment modality. However, radiotherapy may damage the salivary glands and cause xerostomia [2-3,5,7]. In a previous study, we have noted that all NPC patients treated by radiotherapy suffered from dry mouth [4]. Clinically, a subjective grading system has been developed by RTOG to describe the severity of xerostomia [10] in which dry mouth is divided into grade 1-4. However, the clinical grading is a subjective system and different patients and physicians may give different grading for the same extent of dryness. Another method of describing the severity of xerostomia is to measure the salivary flow rate directly [3,6,8,11]. Although this provides a quantitative approach for defining the severity of dry mouth, the procedure is time consuming and requires extra setup and personnel.

The radioisotope $^{99m}$Tc-pertechnetate can be concentrated in the intralobular ductule cells of the salivary gland. This mechanism has been used to perform salivary scintigraphy in the evaluation of a variety of salivary gland disorders [1,12]. Its usefulness to evaluate salivary function after radiotherapy has been demonstrated in patients with head and neck malignancies [9,13]. It is found that with lower radiation doses, excretory dysfunction is mainly responsi-

ble for dry mouth whereas at a higher dose both a decreased trapping ability and excretory impairment are the underlying causes for xerostomia [9]. This is a convenient non-invasive approach for assessing the severity of dry mouth after radiotherapy, both qualitatively and quantitatively. The present paper reports our experience using sialoscintigraphy on NPC patients treated by radiotherapy.

MATERIALS AND METHODS

This analysis includes 28 nasopharyngeal cancer (NPC) patients and 38 sialoscintigraphies. The details of age and sex distribution of the patients are listed in Table 1. The sialoscintigraphies were grouped as pre-radiotherapy (pre-RT), low dose ($< 1050$ cGy), and high dose ($> 1050$ cGy) according to the radiation dose given to the patients when the scanning was performed. Apart from 3 patients who received 2 scannings (2 at pre-RT + high dose, 1 at low dose + high dose), the other 26 patients received only one test. Another 8 normal adults were included as controls.

Patients were given 10 mCi $^{99m}$Tc-pertechnetate intravenously and scanned immediately on a supine position. Scanning was routinely continuous and anterior-posterior images of the head and neck region were obtained. Twenty minutes later 200 ml of lemon juice was given by mouth and the patient was scanned for