EFFECT OF IODINE-131 ON SALIVARY GLAND FUNCTION AND QUALITY OF LIFE IN PATIENTS WITH THYROID CANCER

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ABSTRACT

Objective: *To explore the clinical efficacy of iodine-131 in the treatment of thyroid cancer and its influence on salivary gland function and quality of life.*

Methods: *A total of 72 patients with thyroid cancer were randomly selected from April 2018 to January 2020 in our hospital. The patients were treated with iodine-131 after thyroidectomy. Prednisone was routinely taken 2 days before taking iodine for 7 days. The patient experienced increased saliva secretion 2 h after taking iodine, drank more water, and had increased urination and defecation.*

Results: *The average age of thyroid cancer patients was 48.15±6.81 years old; 13.89% of them were male, and 86.11% of them were female; 5.56% had papillary carcinoma, and 94.44% had follicular carcinoma; 8.33% were stage II, 61.11% were stage III a, 26.39% were stage III B, 4.17% were stage IV. Most (87.95%) patients had lymph node metastases (a total of 83 metastases). Of 72 patients, 52 cases (72.22%) were completely cleared, and 20 cases (27.78%) were incompletely cleared. The cure rate was 59.04%, the effective rate was 32.53%, and the invalid rate was 8.43%. Compared with that before treatment, the proportion of normal salivary gland uptake function and secretion function of thyroid cancer patients decreased significantly after treatment. The proportion of mild, moderate and severe dysfunction increased significantly ($P<0.05$). Compared with before treatment, the scores of psychological, mental, physiological, environmental, independence and social function of patients with thyroid cancer were significantly increased after treatment; that is, the patients' quality of life was significantly improved ($P<0.01$).*

Conclusion: *Iodine-131 treatment of thyroid cancer can significantly inhibit the growth of thyroid tissue metastasis and improve patients' quality of life, but the treatment process will have a certain impact on the salivary gland function of patients.*

Keywords: *Iodine-131, thyroid cancer, clinical efficacy, salivary gland function, quality of life.*

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Introduction

Thyroid cancer is the most common malignancy of the endocrine system, accounting for about 1.5% of all malignancies. Studies have found that the incidence peak of thyroid cancer is 30-39 years old in women and 70-79 years old in men, and the incidence of thyroid cancer in women is significantly higher than that in men[(1)]. The pathological characteristics of thyroid carcinoma can be divided into papillary carcinoma, follicular carcinoma, medullary carcinoma and undifferentiated carcinoma. Papillary carcinoma and follicular carcinoma are collectively called differentiated thyroid carcinoma. The clinical manifestations of thyroid cancer are relatively insidious; the course of the disease is long, the development is slow, and the malignant degree is low compared with other pathological types. However, it metastasizes easily, involving other important organs and tissues, and has a serious impact on the life and health of patients[(2)]. Studies at home and abroad have reported that surgery combined

with postoperative iodine-131 is an important method for the treatment of thyroid cancer[3, 4]. After surgical resection of the primary thyroid, iodine-131 treatment is an important method of removing the remaining postoperative thyroid tissue, detecting and treating thyroid cancer metastasis, and reducing the recurrence rate of thyroid cancer. In this study, thyroid cancer patients treated in our hospital from April 2018 to January 2020 were selected as the research subjects. Iodine-131 treatment was applied to explore the clinical efficacy of this treatment of thyroid cancer patients and its effects on salivary gland function and quality of life.

Materials and methods

Basic information

A total of 72 thyroid cancer patients treated in our hospital from April 2018 to January 2020 were randomly selected. The studies were approved by the hospital's ethics committee and in line with the principles of medical ethics.

Inclusion criteria:

• All patients met the guidelines for the diagnosis and treatment of thyroid cancer[5], and were confirmed by pathological diagnosis;

• Patients had a certain degree of education;

• All patients received iodine-131 treatment for the first time;

• Complete data of salivary gland functional nuclides were found;

• Patients are able to cooperate with treatment;

• All thyroid patients and their family members gave informed consent and signed informed consent.

Exclusion criteria:

• Having related mental dysfunction;

• Previous changes in salivary gland function, such as dry mouth and taste change;

• Pregnant or lactating patients;

• Patients with severe liver and kidney dysfunction or heart dysfunction;

• Patients with incomplete medical records or dropouts;

• Patients who had used thyroxine or iodine-containing diet within 2 months before the study.

Treatment methods

After thyroidectomy, the patient was given iodine-131 treatment and routine oral prednisone (Zhejiang Xianju Pharmaceutical Co., Ltd., batch number: 33171207, specification: 5 mg* 100s) for 2 days before iodine administration, 10 mg each time, 3 times a day, for 7 days continuously. The patient experienced increased saliva secretion 2 h after taking iodine-131, drank more water, and had increased urination and defecation.

Observation indexes

The basic clinical data of thyroid cancer patients were analyzed, including age, sex, course of disease, clinical case type (papillary carcinoma, follicular carcinoma), TNM stage (II stage, stage A, stage B, and phase B), and site of metastasis (lymph node metastasis, lung metastasis, and other metastasis).

Clinical efficacy

After 5 months of iodine-131 treatment, the patient was reexamined. If the thyroid bed of iodine-131 imaging had no thyroid tissue development, it was deemed as complete clearance; otherwise, it was deemed as incomplete clearance. The metastatic lesions were cured according to the systemic iodine-131 scan, negative anti-thyroglobulin antibody and less than 1.0 μg/L high-sensitive thyroglobulin. Iodine-131 imaging showed that the uptake of iodine-131 was reduced or disappeared in the metastatic foci, or the number of metastatic foci was reduced compared with that before treatment, and the level of highly sensitive thyroglobulin was reduced or disappeared with negative anti-thyroglobulin antibody. Compared with pre-treatment, new metastases were detected, or the number of metastases was increased, or the old metastases were grown, or the function of iodine-131 was enhanced, and the negative anti-thyroglobulin antibody and high sensitive thyroglobulin levels were not effective. Salivary gland function was determined as follows: the patient was placed in a supine position with the head slightly backward, and the head was fixed. The probe field included the bilateral parotid glands and submandibular glands. The bilateral parotid glands and submandibular glands were continuously imaged at 1 frame/min for 30 min. Images were evaluated by two blinded people with the title of physician. These physicians reviewed the related clinical reports and the images of the radioactive uptake in the palate. They evaluated the salivary gland function in patients in terms of intake and secretion function. The patients showed a mix of normal and mild, moderate and severe dysfunction.

The evaluation was quantified as follows:

• Uptake index (UI) = (Cmax of the gland – B of the temporal background) ÷ B;

• Secretory index (SI) = (Cmax – Gland minimum radioactivity count (Cmin) after vitamin C stimulation) ÷ Cmax × 100%.

UI ≥5 and SI ≥40% were considered normal salivary uptake and secretion. 3.5 ≤UI <5 and 20% ≤SI <40% were regarded as mild dysfunction of saliva uptake and secretion. 2 ≤UI < 3.5 and 10% ≤SI <20% were considered moderately impaired salivation uptake and secretion. UI <2 and SI <10% were considered as severely impaired salivary uptake and secretion.

Quality of life

The changes in the quality of life of thyroid cancer patients before treatment were measured using the World Health Organization quality of life measurement scale.

The scale evaluates psychological, spiritual, physiological, environmental, independence and social function factors, with a single score of 20 points maximum. The higher the score, the better the quality of life. Patients and their family members were first asked whether they knew about their condition. Face-to-face and one-to-one interview modes were adopted.

Relevant items were explained by the same investigator, and patients were instructed to complete the measurement form independently.

Statistical methods

The SPSS22.0 software package was used for statistical data analysis in this study. The statistical data were tested by the χ^2 test. The independent sample t-test was used to compare measurement data between groups, and the paired sample t-test was used for comparison before and after treatment. When comparing results, P<0.05 indicates that the difference is statistically significant.

Results

Analysis of basic clinical data of thyroid cancer patients

The mean age of thyroid cancer patients was 48.15±6.81 years old; 13.89% males and 86.11% females. In the clinicopathological classification, 5.56% of the patients had papillary carcinoma, and 94.44% had follicular carcinoma.

In the TNM stage, 8.33% were II stage, 61.11% were Na stage, 26.39% were N stage B, and 4.17 were N stage. The most common metastatic sites were lymph nodes (87.95). See Table 1.

Group	Thyroid cancer patients (n = 72)
Age (year)	48.15 ± 6.81
Gender	
Male	10 (13.89)
Female	62 (86.11)
Course of disease (year)	2.53 ± 0.92
Clinical case classification	
Papillary carcinoma	4 (5.56)
Follicular carcinoma	68 (94.44)
TNM stage	
II	6 (8.33)
IIIa	44 (61.11)
IIIb	19 (26.39)
IV	3 (4.17)
Metastatic sites (83 metastatic foci)	
Lymph node metastasis	73 (87.95)
Pulmonary metastasis	4 (4.82)
Other transfer	6 (7.23)

Table 1: Analysis of basic clinical data of thyroid cancer patients ($\bar{x}\pm s$, %).

Clinical efficacy of iodine-131 in thyroid cancer patients

Among 72 patients, 52 cases (72.22%) were completely cleared, and 20 cases (27.78%) were incompletely cleared. Of the 72 patients with thyroid cancer, 83 metastases occurred. The cure rate of the metastases was 59.04%, the effective rate was 32.53%, and the inefficiency was 8.43%. These data are shown in Table 2.

Transfer area	n	Cure	Effective	Inefficiency
Lymph node metastasis	73	48 (65.75)	23 (31.51)	2 (2.74)
Pulmonary metastasis	4	1 (25.00)	2 (50.00)	1 (25.00)
Other transfer	6	0 (0.00)	2 (33.33)	4 (66.67)
total	83	49 (59.04)	27 (32.53)	7 (8.43)

Table 2: Clinical efficacy of iodine-131 in thyroid cancer patients (%).

Effect of iodine-131 treatment on salivary gland function in patients with thyroid cancer

Compared with before treatment, the proportion of normal salivary gland uptake and secretion function in thyroid cancer patients decreased significantly after treatment, and the proportion of mild, moderate and severe dysfunction increased significantly (P<0.05). See Table 3.

Group	Uptake function		Z	P	Secretion function		Z	P
	Before	After			Before	After		
Normal	56	39	11.691	0.009	54	40	8.633	0.035
Mild dysfunction	15	24			16	22		
Moderate dysfunction	1	6			2	8		
Severe dysfunction	0	3			0 (0.00)	2		

Table 3: Influence of iodine-131 treatment on salivary gland function in patients with thyroid cancer (%).

Effect of iodine-131 treatment on quality of life of thyroid cancer patients

Compared with before treatment, thyroid cancer patients' psychological, mental, physiological, environmental, independence and social function scores were significantly increased after treatment; that is, patients' quality of life was significantly improved (P<0.01). See Table 4.

Group	Quality of life (n = 72)		t	P
	Before treatment	After treatment		
Psychological	12.78±1.04	17.83±1.08	28.580	< 0.001
Menta	12.69±1.01	17.78±1.05	29.645	< 0.001
Physiological	13.45±1.07	17.67±1.05	23.886	< 0.001
Environmental	13.56±1.06	15.59±1.03	11.654	< 0.001
Independence	13.46±1.06	18.11±1.05	26.445	< 0.001
Social Function	12.88±1.12	16.35±1.07	19.009	< 0.001

Table 4: Influence of iodine-131 treatment on quality of life of thyroid cancer patients.

Discussion

Thyroid carcinoma is the most common endocrine malignancy observed in clinical practice. Most thyroid tumors are primary and mainly originated from thyroid epithelial cells, from follicular epithelial cells. A few originated from parafollicular cells, vascular endothelium, lymphatic tissue or from tumor metastasis in other parts of the body[6]. Differentiated epithelial cells are one of the most rapidly increasing malignancies in the world. It is mainly treated with surgery combined with postoperative iodine-131 treatment[7]. It is impossible to completely remove the thyroid during surgery, and a small amount of normal thyroid tissue must be left. Therefore, after thyroid surgery, iodine-131 radiation therapy is needed to remove the postoperative residual thyroid tumor or distant metastatic tumor and break down the remaining thyroid tissue[8]. Iodine-131 has been widely used in the clinic to treat thyroid cancer because thyroid cancer cells and their metastases have a strong iodine absorption capacity[9]. The treatment relies on the beta rays released in the process of iodine-131 decay to kill normal cells and cancer cells within a range of about 2 mm, thereby damaging the function of cancer cells and thyroid tissue, inhibiting thyroid secretion, and thereby inhibiting the metastasis and recurrence of patients[10].

Saliva is foamlike, mainly secreted by the salivary glands, helps with lubrication and dissolution of food, moistens and protects the oral mucosa, buffers adverse stimulation and has other roles. Sodium iodine co-transporters exist on the cell membranes of lobular duct epithelial cells of salivary glands that can mediate the active transport of iodide into the glycation membrane protein of thyroid follicular cells and collect iodide ions into thyroid cells in a reverse concentration gradient[11]. Sodium iodine co-transporters can be detected in salivary glands, gastric mucosa, mammary glands, lacrimal glands and many other non-thyroid tissues[12].

Studies have found that the salivary glands are irradiated by β-rays during the absorption and transportation of iodine-131, which may lead to chronic salivary adenitis and other complications, mainly manifested as dry mouth, peculiar smell and hypotaste[13]. However, due to different sensory thresholds for dry mouth and related symptoms in different patients, some patients did not show obvious symptoms of dry mouth, although salivary gland function was abnormal. It has been reported that salivary gland function will decrease to varying degrees in patients with differentiated thyroid cancer after iodine-131 treatment[14]. Those results are the same as those of this study. These results indicated that although iodine-131 treatment of thyroid cancer can inhibit the growth of metastases, it will cause different degrees of salivary gland function damage.

With the development of the social economy and the improvement of living standards, people's concept of health has gradually changed, and they have begun to pay more attention to the quality of life rather than the traditional disease evaluation indicators such as morbidity and prevalence rate. Evaluation of quality of life is an important aspect of care for cancer patients[15]. The results of this study showed that psychological, mental, physiological, environmental, independence and social function scores of thyroid cancer patients were significantly

increased after iodine-131 treatment. These results suggest that iodine-131 treatment can significantly improve the quality of life of thyroid cancer patients.

In conclusion, iodine-131 treatment of thyroid cancer can significantly inhibit the growth of thyroid tissue metastasis and improve the quality of life of patients, but it will have a certain impact on the salivary gland function of patients during the treatment process.

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