

Clinical Value of Combined Serum CEA and Tg Test in Benign and Malignant Thyroid Tumors

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Abstract: Thyroid tumor is one of the common and frequent tumors in the endocrine system, and its incidence is becoming more and more serious in recent years. Surgery is the best treatment method at this stage, but the difference of benign and malignant is directly related to the extent of resection and prognosis of the tumor, which may lead to a series of complications. Nowadays, interventional therapy is also used in the treatment of thyroid malignancies, so understanding the intratumoral and thyroid blood supply arteries has become a new research hotspot. This paper focuses on the analysis and investigation of the value of combined serum CEA and Tg tests in benign and malignant thyroid tumors to provide reliable reference data for clinical treatment.

Keywords: thyroid gland; benign and malignant tumors; serum CEA; Tg; diagnostic effect

1. Introduction

Thyroid tumors are common endocrine tumors that can be benign nodules or malignant cancers. The pathogenesis of thyroid tumors is unknown, but a number of factors may increase a person's risk of developing a thyroid tumor. These factors include age, gender, family history, radiation exposure, and nutritional deficiencies. The groups characterized by the development of thyroid tumors are women, elderly people and those with a history of radiation exposure. Clinical symptoms vary depending on the condition. Mild cases may be asymptomatic, while more severe cases may exhibit enlarged thyroid gland, difficulty in breathing due to compression of the trachea, and discomfort in swallowing due to compression of the esophagus. Benign thyroid tumors are usually slow growing, non-invasive to surrounding tissues, rarely recur after treatment, and do not pose a threat to patients' lives. Common types of benign thyroid tumors include nodular goiter, follicular adenoma, and papillary thyroid adenoma. There are different types of malignant thyroid tumors, but the most common type is differentiated thyroid cancer. Malignant thyroid tumors can invade surrounding tissues and lymph nodes and spread throughout the body. It is difficult to treat and is prone to recurrence after treatment. Thyroid cancer usually requires surgical removal and may require adjuvant treatment with radiation therapy or chemotherapy. With early diagnosis, benign thyroid tumors can usually be treated well. Therefore, it is important for people with thyroid disease to have regular thyroid examinations to detect and treat thyroid tumors in a timely manner. The incidence of thyroid tumors is the highest among endocrine tumors, and surgery combined with radiotherapy can significantly improve the 5-year survival rate of patients^[1]. Epidemiology shows that the prevalence of thyroid tumors in China has been increasing in recent years, becoming a major disease affecting human physical and mental health and quality of life, which is receiving more and more attention. The disease is benign and malignant, and is highly susceptible to lymphatic and hematologic metastasis, which requires timely treatment^[2]. At present, thyroid tumor is a very common tumor disease, and its detection methods are roughly divided into traditional methods such as physical examination, ultrasound examination, nuclear scan and tissue biopsy. These traditional detection methods have their own advantages and disadvantages. Firstly, physical examination can not directly detect thyroid tumor, but by observing external parts such as eyes, lips, skin and nails, it can initially determine whether there is a possibility of thyroid tumor, this method is suitable for primary screening, but its accuracy is not very high and cannot directly determine the diagnosis. Secondly, ultrasonography is one of the commonly used methods to detect thyroid tumor. Its principle is to use the reflection of sound waves to image, which can clearly observe the size, shape and structure of thyroid gland, and has high accuracy for both initial screening and diagnosis. However, the disadvantage is that it is not possible to determine the benignity or malignancy, and it is not effective in detecting lesions deep in the tissue. The third method is nuclear

scan, which can clearly observe the internal structure of the thyroid gland and has a high degree of accuracy in detecting lesions that are difficult to detect. Finally, tissue biopsy is one of the most direct and accurate detection methods. The principle is to obtain tissue samples from the lesion through puncture or surgery, and observe the tissue structure and lesion through a microscope, which is highly accurate for accurate diagnosis and determination of benign and malignant. However, the disadvantage is that it is complex and risky, and may require special conditions such as anesthesia to perform. In general, traditional testing methods have their own advantages and disadvantages, and may result in false negative puncture or suspicious malignancy, so the combination of serology has a positive effect on the detection rate of thyroid tumors. Thyroid tumors often present with a neck mass and elevated serum calcitonin^[3]. The combined serum CEA and Tg test is a commonly used tumor marker test. CEA (carcinoembryonic antigen) is a glycoprotein that is usually highly expressed in malignant tissues of organs such as the gastrointestinal tract and the pancreas, as well as in many other malignancies such as lung and breast. Therefore, CEA can be used as one of the markers of malignant tumors in blood. Testing the concentration of CEA can help doctors determine whether a patient has certain malignancies. tg (thyroglobulin) is a protein secreted when the thyroid gland is functioning normally and can be elevated in the presence of malignant thyroid tumors or metastatic thyroid cancer. Therefore, Tg can be used as one of the markers of thyroid cancer. Testing the concentration of Tg can help doctors determine whether a patient has thyroid cancer or whether thyroid cancer has recurred. The significance of combined testing of CEA and Tg is that different types of malignant tumors can cause elevated concentrations of CEA and Tg, so combined testing can increase the sensitivity of detection of the tumor. For example, both gastric cancer and breast cancer can cause elevated CEA, while both thyroid cancer and breast cancer can cause elevated Tg. If CEA and Tg are tested simultaneously, tumors can be detected more quickly and accurately. Moreover, related studies have indicated that serum carcinoembryonic antigen (CEA) is regarded as a biological feature with embryonic antigen-like determinant clusters, and also has a close correlation in the development and progression of many tumors^[4]. In this study, an analysis of thyroid tumor patients admitted from 01/2022 to 01/2023 was conducted to further analyze the effect and value of combined CEA and Tg measurement. The following report is presented.

2. Data and methods

2.1 General data

Patients with thyroid tumors who visited our hospital from January 2022 to January 2023 were selected for the study, with a total of 72 cases, grouped according to pathological diagnosis, i.e. benign thyroid group (group A) and malignant thyroid group (group B), with 36 cases included in each group. group A: male/female = 21/15, age 35-70 (51.52±3.36) years; disease type: papillary carcinoma, follicular carcinoma, 28 and 8 cases respectively; group B: male/female = 22/14, age 38-70 (52.65±3.41) years; disease type follicular carcinoma accounted for 28 and 8 cases respectively; Group B: M/F=22/14, age 38~70 (52.65±3.41) years; disease type: thyroid cancer and nodular goiter accounted for 24 and 12 cases respectively, the sample data of the two groups were compared, ($P>0.05$), and comparative value existed. Implementation was approved by the Medical Ethics Committee.

Inclusion criteria: (1) meeting clinical determination criteria and confirmed by pathological diagnosis; (2) patients were informed and participated in the study; (3) high data completeness.

Exclusion criteria: (1) concurrent with other functional thyroid conditions; (2) severe lesions such as liver, kidney and lung; (3) previous history of thyroid surgery; (4) with other malignant tumors; (5) allergic body; (6) withdrawal in the middle of the study.

2.2 Methods

CEA and Tg are thyroid tumor markers, and their combined measurement can improve the accuracy of detection. CEA is a carcinoembryonic antigen, which is present in malignant tumors such as liver, lung and colon; Tg is an intrinsic protein of thyroid gland, which is only expressed in thyroid cells. Therefore, if CEA and Tg are tested simultaneously, the malignancy and prognosis of thyroid cancer can be more accurately determined. Specifically, the combination of CEA and Tg for thyroid tumor determination is as follows:

First, identify the patients who need the test, including patients who have been diagnosed with thyroid tumor, surgically removed patients and follow-up patients. Second, blood samples are collected, usually using peripheral veins, with attention to aseptic technique and avoidance of contamination. Third, the

blood is added with sodium citrate anticoagulant (3 ml), processed by centrifugation (5 min, 1000 r/min), and taken to an immunoassay analyzer to complete the assay by chemiluminescence with its associated supporting reagents. For the analysis of both CEA and Tg, the chemiluminescence assay (CLIA) or enzyme-linked immunosorbent assay (ELISA) was generally used. Fourth, to judge the results of CEA and Tg assays, if the concentrations of both CEA and Tg are higher than normal, it indicates that the thyroid tumor may be at risk of malignant transformation. Fifthly, combining with the patient's clinical manifestations, pathological examination and other information, the malignancy degree and prognosis of thyroid tumor will be comprehensively evaluated, and a reasonable treatment plan will be formulated. It should be noted that although the combined determination of CEA and Tg can improve the accuracy of thyroid tumor detection, it cannot completely replace other examination methods, such as ultrasonography, CT examination, nuclear scan, etc. In addition, there are some differences in the test results from different laboratories, so the test and analysis should be performed under the guidance of professional doctors.

2.3 Observation index

The comparison of serum CEA and Tg values between the 2 groups was conducted and the diagnostic efficacy of the related indexes was evaluated. the normal range of CEA was 0~5 μ g/L; the normal range of Tg was 5~40 μ g/L.

2.4 Statistical analysis

The statistical software of SPSS25.0 was used to unfold the processing, and the measurement data were verified and described by t, and the count data were expressed by 2 test, %, and the statistical data were analyzed by SPSS25.0, and P < 0.05 was statistically significant.

3. Results

3.1 Analysis of serum CEA and Tg status in two groups

The serum CEA and Tg in group B were significantly higher than those in the control group, with statistical differences (P < 0.05), as shown in Table 1.

Table 1 Analysis of the status of serum CEA and Tg in the two groups ($\bar{x} \pm s$, μ g/L)

Groups	CEA	Tg
Group B(n=36)	17.22 \pm 8.55	46.25 \pm 17.22
Group A(n=36)	2.66 \pm 2.16	32.50 \pm 18.66
t	9.906	3.249
P	< 0.001	0.002

3.2 Analysis of the diagnostic efficacy of serum CEA and Tg in benign and malignant thyroid tumors

Tg combined with serum CEA indexes alone and in combination (CEA and Tg) has high sensitivity and specificity in the diagnosis of thyroid tumor diseases, as shown in Table 2.

Table 2 Analysis of the diagnostic efficacy of serum CEA and Tg in benign and malignant thyroid tumors (n, %)

Groups	Threshold	Sensitivity	Specificity
Tg	65.36	91.67%(33/36)	94.44%(34/36)
CEA	5.14	97.22%(35/36)	88.89%(32/36)

4. Discussion

Thyroid tumors are tumors that form in the thyroid tissue. In terms of the high incidence population, women are more likely to develop thyroid cancer than men, and the risk of developing the disease gradually increases with age. In addition, family history, previous radiation treatment to the head and neck, and atrophic thyroiditis are also associated with the development of thyroid tumors. In terms of pathological types, thyroid tumors are mainly classified as benign and malignant, among which

malignant includes papillary carcinoma, follicular carcinoma, medullary carcinoma, undifferentiated carcinoma and other types. The incidence of thyroid tumors is on the rise worldwide and is concentrated in young adults. The principle of thyroid tumor development is still not fully understood, but mutation of trypanosomal virus gene and gene dysregulation may be one of the key factors to cause thyroid tumor. In addition, factors such as environmental pollution, malnutrition and stress may also play a role in the occurrence of thyroid tumors. At present, common methods of thyroid tumor detection include clinical performance observation, physical examination, ultrasonography, fine needle aspiration biopsy, nuclear scan and serological test. First of all, clinical observation and physical examination is a simple primary screening method to initially determine whether there are abnormalities in the thyroid gland by observing whether the patient has symptoms such as neck lumps, shortness of breath, cough, and whether the lymph nodes in the neck are enlarged. The advantage of this method is that it is easy to perform and does not require special equipment, but the disadvantage is that it is difficult to detect early thyroid cancer. Ultrasonography is currently one of the most commonly used methods in thyroid tumor detection. Its main features are non-invasive, accurate and convenient. Ultrasonography can help doctors determine the size, shape and location of thyroid tumors and can help detect the nature, number and lymph node metastasis of the tumors. The disadvantage of ultrasonography is that it cannot distinguish benign and malignant tumors and needs to be combined with other tests for diagnosis. Fine needle aspiration biopsy, also known as fine needle aspiration cytology, is performed by collecting cells from thyroid tumor tissue to determine the benignity and malignancy of the tumor. This method has the advantage of being less invasive and more accurate, but its disadvantage is that it requires a high level of operator and is prone to complications such as bleeding or infection. Nuclear scan uses radiographic technique to show the morphology and function of thyroid tissue by injecting a small amount of radioactive drug. This method can help identify benign and malignant thyroid nodules, determine the type of hyperthyroidism, etc. However, the disadvantage is that it is limited by the use of radioactive drugs and involves some radiation risk. Finally, serological testing: This includes the detection of tumor markers such as CEA, Tg, and thyroid hormones. These indicators can be used for screening, diagnosis and treatment monitoring of thyroid cancer, and have the advantages of being non-invasive, simple and able to achieve repeated measurements are widely used as one of the diagnostic indicators of thyroid tumors. CEA is a carboxylate peptidase that is mainly found in intestinal mucosa, placenta and liver cells, but is rarely or not at all present in normal thyroid tissue. Tg, on the other hand, is a thyroid-specific protein secreted by thyroid epithelial cells. When a thyroid tumor is malignantly transformed, CEA production increases and the ability of Tg to be secreted decreases, so the condition can be determined by testing both indicators. As a glycoprotein component, CEA can release more cellular vesicles and promote its high level expression in malignant tumor cells and embryonic tissues, while initiating signaling pathway transduction factors in the serum, causing cancer cells to proliferate and increasing the risk of differentiation. The combined detection of serum CEA and Tg has strong advantages. Firstly, high sensitivity: CEA and Tg as tumor markers of thyroid cancer, their combined detection can improve the detection rate of early thyroid tumors, especially for those early cases which are difficult to be judged by ultrasound examination alone, and have a very important diagnostic role. Secondly, the specificity of CEA and Tg is good, and the combined test can exclude the interference of other diseases with these two indicators, thus improving the specificity of thyroid cancer diagnosis. Thirdly, it has strong adjuvant therapeutic effect. For thyroid cancer patients who have undergone surgery, the results of the combined test can evaluate the treatment effect and guide the subsequent adjuvant treatment plan. Fourthly, it is convenient, because the combined test of CEA and Tg can obtain multiple indexes in one blood sample, which is very convenient. The results of this study showed that CEA and Tg were higher in group B than in group A, suggesting that CEA and Tg play an important role in the progression of malignant tumors. cEA can cause the release of follicular epithelial cell carcinoma *in vivo*, triggering carcinogenesis, which in turn leads to disruption of the cancer cell cycle. In a study on the pathogenesis of different types of thyroid cancer, it was found that the abnormal positive expression of CEA and Tg was higher and the protein expression concentration was equally variable. The results of this study showed that CEA has high single diagnostic specificity and low sensitivity and can be considered as a thyroid tumor specific criterion; if its activity is weak, insufficient release can lead to decreased sensitivity. tg has higher sensitivity and specificity in the diagnosis of malignant tumors, and the combination with other indicators is beneficial to improve the diagnostic accuracy. Ye Liuqing et al. pointed out in their study^[5] that the combined diagnosis of CEA and Tg could improve diagnostic accuracy and reduce misdiagnosis and missed diagnosis, which is consistent with the results of this study. Overall, combined testing of CEA and Tg is an affordable, simple and easy method for thyroid cancer diagnosis with high clinical application value. In clinical practice, if the levels of both CEA and Tg are elevated, it suggests that the thyroid cancer is more malignant; if the CEA is elevated and Tg is within the normal range, it suggests that the disease is papillary thyroid cancer; if the levels of both CEA and Tg are low, it suggests that the disease is a benign tumor or other thyroid

diseases.

5. Conclusions

In summary, with the improvement of people's living standard and health awareness, the incidence of thyroid tumor is increasing year by year. Moreover, the early symptoms of thyroid tumor are not obvious and hard to self-perceive, so early diagnosis is very important. In recent years, combined serum CEA and Tg test has become a widely adopted method for thyroid tumor diagnosis. In the early diagnosis of thyroid cancer and treatment plan formulation, the combined test of CEA and Tg has become an important reference indicator. Meanwhile, it has become one of the commonly used comprehensive diagnostic methods for thyroid cancer in clinical practice due to its simple operation, low risk and low error rate. The combined measurement of serum CEA and Tg in benign and malignant thyroid tumors has a high diagnostic value, which can effectively determine the type of disease and assist in clinical formulation of treatment plans.

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