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Assessment of the Diagnostic and Prognostic Efficacy of Combined Detection of Serum Tumor Markers in Patients with Lung Cancer

Jing Liu,Xiao-Mei Hai, Xiu-Qin Chang*

***Correspondence to:** Xiu-Qin Chang, The Fourth People's Hospital of Ningxia Hui Autonomous Region, Yinchuan, Ningxia, 750021, China, E-mail: Changxq0512@163.com

Abstract: Objective: To analyze the application effectiveness of combined detection of serum tumor markers (TM) in lung cancer. **Methods:** Forty cases of lung cancer patients admitted in recent years were included in the observation group A, 50 cases of patients with benign lung lesions were included in observation group B, and 55 cases of healthy examinees during the same period were included in the control group. TM was tested in all three groups, and the diagnostic efficacy was compared. **Results:** The levels of CYFRA21-1, CA125, NSE, SCC, and CEA in the control group, observation group B, and group A showed an increasing trend ($P < 0.05$); the positivity rates of CYFRA21-1 and SCC were the highest in squamous cell carcinoma, while the positivity rates of CA125 and CEA were the highest in adenocarcinoma, and the positivity rate of NSE was the highest in small cell lung cancer ($P < 0.05$). The accuracy and sensitivity of the five-item combined test were higher, and the specificity of CYFRA21-1 test was higher ($P < 0.05$). **Conclusion:** When clinically examining lung cancer, combined detection of TM can effectively detect lung cancer with high diagnostic efficacy, which has promotional value.

Keywords: Serum markers; Lung cancer; Diagnosis; Benign lung lesions

Lung cancer is one of the most common clinical bronchogenic carcinomas, with its incidence increasing year by year. Among all cancers, it has the highest mortality rate. The majority of patients are diagnosed at an advanced stage, leading to a significant decrease in quality of life. Early detection of the disease and appropriate treatment can help control disease progression[1]. Tumor markers (TM) are chemical molecules derived from tumor tissues. Whether produced by the tumor or during the proliferation process, tumor cells form TMs, which enter bodily fluids, cells, and blood, reflecting the growth status of the tumor. Testing for related markers can assist in diagnosing lung cancer and improve diagnostic efficacy. However, using a single marker may result in lower accuracy and sensitivity, ultimately affecting the overall diagnostic outcome. It is recommended to conduct combined testing, although there is currently limited research on this approach. This study focuses on patients with lung cancer to analyze the application effectiveness of combined TM examinations.

1. Materials and Methods

1.1 General Information

Forty cases of lung cancer patients admitted in recent years were included in observation group A, comprising 22 males and 18 females, aged 33-76 years with a mean age of (56.64±4.26) years; 50 cases of patients with benign lung lesions were included in observation group B, comprising 26 males and 24 females, aged 34-77 years with a mean age of (56.71±4.18) years; Additionally, 55 healthy examinees during the same period were included in the control group, comprising 28 males and 27 females, aged 32-78 years with a mean age of (55.85±4.16) years. There were no significant differences in general information among the three groups ($P > 0.05$), indicating comparability[2].

1.2 Instruments and Methods

Instruments: Fully automatic electrochemiluminescence analyzer, model AutoLumo42000 Plus, with reagents from the instrument's matching reagent kit. All instrument and experimental operations strictly followed the instructions.

Methods: TM was tested in all three groups. 5 ml of fasting blood was collected from patients in the early morning, left to stand for 1 hour, centrifuged at a speed of 3000 r/min for 5 minutes, and 200 μl of serum was taken for tumor marker detection. Serum that could not be tested immediately was collected and sealed in EP tubes and stored frozen at -20°C in a refrigerator for no more than 30 days.

Result interpretation: The normal values for CYFRA21-1, CA125, NSE, SCC, and CEA were 0-0.33 ng/mL, 0-35 U/mL, 0-17 ng/mL, 0-1.5 ng/mL, and 0-5 ng/mL, respectively. Detection results exceeding the normal range by 2 times were considered positive[3].

1.3 Observation Items and Indicators

Evaluation of TM test results in three groups: Observing the results of CYFRA21-1, CA125, NSE, SCC, and CEA tests in three groups. Evaluating the detection of different types of lung cancer TM: Including adenocarcinoma, squamous cell carcinoma, and small cell carcinoma, counting the number of positive cases for each TM, and calculating the detection rate. Evaluating the efficacy of TM combined testing: Calculating the accuracy, specificity, and sensitivity of single tests for five kinds of TM, CYFRA21-1+NSE+CEA, CYFRA21-1+NSE+SCC+CEA, and combined testing.

1.4 Statistical Methods

SPSS 27.0 was used for data analysis. ($\overline{x} \pm s$) and (%) represent measurement and count data, respectively. t-test and chi-square test were used, with $P < 0.05$ indicating statistical significance.

2. Results

2.1 Comparison of TM Test Results among Three Groups

The levels of CYFRA21-1, CA125, NSE, SCC, and CEA in the control group, observation group B, and group A showed an increasing trend ($P < 0.05$). See **Table 1** for details.

Table 1 Comparison of TM Test Results among Three Groups [$n(\overline{x} \pm s)$]

Group Number	Example number	CYFRA21-1(ng/mL)	CA125(U/mL)	NSE(ng/mL)	SCC(ng/mL)	CEA(ng/mL)
Observation Group A	40	11.15±1.44ab	25.25±4.78ab	24.47±3.49ab	7.23±1.25ab	35.88±4.49ab
Observation Group B	50	2.14±0.24a	15.57±1.23a	11.67±2.00a	2.00±0.26a	8.65±1.24a
Control Group	55	1.11±0.23	11.13±1.60	7.31±1.23	0.72±0.12	1.47±1.00

Note: Compared with the control group, a$P < 0.05$; compared with observation group B, b$P < 0.05$.

2.2 Comparison of TM Detection Rates for Different Types of Lung Cancer among Three Groups

The positivity rates of CYFRA21-1 and SCC were highest in squamous cell carcinoma, while the positivity rates of CA125 and CEA were highest in adenocarcinoma, and the positivity rate of NSE was highest in small cell lung cancer ($P < 0.05$). See **Table 2** for details[4].

Table 2 Comparison of TM Detection Rates for Different Types of Lung Cancer among Three Groups [n(%)]

Group Number	Example number	CYFRA21-1	CA125	NSE	SCC	CEA
Small Cell Lung Cancer	10	4(40.00)	3(30.00)	8(80.00)	1(10.00)	4(40.00)

Continuation Table:

Group Number	Example number	CYFRA21-1	CA125	NSE	SCC	CEA
Squamous Cell Carcinoma	12	9(75.00)a	3(25.00)a	5(41.67)a	6(50.00)a	5(41.67)
Adenocarcinoma	18	2(11.11)ab	16(88.89)ab	5(27.78)ab	2(11.11)b	9(50.00)ab

Note: Compared with the positivity rate of small cell lung cancer, a$P < 0.05$; compared with the positivity rate of squamous cell carcinoma, b$P < 0.05$.

2.3 Comparison of Efficacy of Combined TM Testing

The accuracy of CYFRA21-1 was 55.80%, with a specificity of 71.50% and a sensitivity of 41.50%; For CA125, the values were 56.85%, 85.50%, and 67.80% respectively; NSE had values of 57.30%, 85.00%, and 67.80%; SCC had values of 58.60%, 81.25%, and 54.50%; CEA had values of 55.50%, 71.60%, and 41.50%; CYFRA21-1+NSE+CEA had values of 79.60%, 81.50%, and 82.50% respectively; CYFRA21-1+NSE+SCC+CEA had values of 78.65%, 80.50%, and 83.45% respectively; The five-item combined testing had values of 81.75%, 74.65%, and 92.20%. The accuracy and sensitivity of the five-item combined test were higher, with CYFRA21-1 examination having higher specificity ($P < 0.05$)[5].

3. Discussion

Lung cancer is a common malignant tumor with high incidence and mortality rates. Early identification and treatment of the disease can strengthen therapeutic efficacy. However, due to the lack of specificity in the early stages and the tendency of lung cancer to affect neighboring tissues, it is often difficult to detect early, resulting in a low early detection rate. By the time patients seek medical attention, the disease is often in the middle to late stages, leading to poor clinical outcomes and potential life-threatening situations. Therefore, employing effective techniques for early detection and diagnosis of lung cancer is crucial. Additionally, during the course of treatment for tumor patients, changes in tumor marker levels in the serum are of significant research interest. Detecting TM indicators in serum can serve as an auxiliary diagnostic basis for lung cancer, with minimal invasiveness and good patient compliance, attracting attention from many quarters.

During tumor growth, various substances are produced due to tumor stimulation or abnormal malignant cell appearance. Clinical assessment using TM allows for the evaluation of tumor severity. TM measurement not only aids in disease diagnosis but also assesses prognosis. TM examination can detect early cancer and evaluate treatment efficacy. As the range of TM usage expands, serum TM levels in lung cancer patients are significantly abnormal and higher compared to healthy populations. In a study by Liu Xuehua et al., which included 80 cases of benign lung lesions and 80 cases of lung cancer, TM examination revealed higher TM levels in the latter group. Regarding specific tumor markers[6], CYFRA21-1 elevation not only reflects cytokeratin release, death, and decomposition but also presents cell keratin filament degradation. Clinically, CYFRA21-1 can aid in evaluating lung cancer histological types with high sensitivity. CA125 exhibits high sensitivity, particularly for mixed-type tumor markers, with a high positivity rate. Moreover, for advanced lung cancer patients undergoing chemotherapy, CA125 can serve as an important indicator. NSE, primarily concentrated in neurons and nerve cells, serves as both a treatment marker and a clinical staging evaluator for small cell lung cancer. Additionally, for lung cancer bone metastasis, NSE can act as an independent risk factor, enabling early lung cancer detection. SCC, belonging to squamous epithelial cell antigens, exhibits a significant increase in content after pharyngeal or lung tumors occur. Clinically, SCC can assess disease severity. Particularly for lung squamous cell carcinoma, SCC has high specificity, with a positivity rate ranging from 40-60%. For SCLC, the positivity rate is approximately 49%, and for NSCLC, it is approximately 55%, both higher than CEA. The sensitivity of CEA is significantly higher than SCC. In serum, SCC has a short half-life, becoming negative 1-3 days after radical surgery, and increasing significantly after metastasis or recurrence. CEA, an immunoglobulin originating from endodermal cells, forms in plasma, can transfer to extracellular space through cell membranes, and then reach body fluids, including urine, blood, and excreta, where it can

be detected. This marker belongs to broad-spectrum tumor markers, with evident immunosuppressive effects, involved in tumor metastasis. Early-stage lung cancer shows a significant increase in CEA levels[7]. CEA has high specificity and sensitivity, effectively distinguishing malignant tumors and facilitating disease monitoring and treatment evaluation.The results of this study showed an increasing trend in CYFRA21-1, CA125, NSE, SCC, and CEA levels in the control group, observation group B, and group A ($P < 0.05$). This indicates that combined TM examination can effectively detect lung diseases and identify the nature of lesions, facilitating early detection of lung cancer. The positivity rates of CYFRA21-1 and SCC were highest in squamous cell carcinoma, while the positivity rates of CA125 and CEA were highest in adenocarcinoma, and the positivity rate of NSE was highest in small cell lung cancer ($P < 0.05$). This suggests that combined TM testing holds high value in the diagnosis of lung cancer. The accuracy and sensitivity of the five-item combined test were higher, with CYFRA21-1 examination demonstrating higher specificity ($P < 0.05$), indicating that combined TM examination has higher diagnostic efficacy for lung cancer[8].

In conclusion, the joint detection of TM in serum of suspected lung cancer patients can be effectively utilized for diagnosis and evaluation of treatment effects, holding significant value for promotion in clinical practice.

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