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Application of Chemiluminescence Immunoassay in Tumor Biomarker Test and Its Effect on Improving Diagnostic Accuracy

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Abstract

Objective: to analyze the role of chemiluminescence immunoassay in the detection of tumor biomarkers in improving the diagnostic accuracy. Methods: 120 tumor patients treated in our hospital from June 2020 to June 2021 were selected as the observation group; 120 healthy persons who underwent physical examination in our hospital in the same period were selected as the control group. The study subjects were tested for tumor biomarkers by chemiluminescence immunoassay. The tumor conditions were diagnosed by serum carcinoembryonic antigen (CEA), carbohydrate antigen 199 (CA199), carbohydrate antigen 153 (CA153), alpha fetoprotein (AFP) and carbohydrate antigen 125 (CA125), and compared with the results of pathological examination. Results: there were significant differences in CEA, CA199, CA153, AFP and CA125 between the observation group and the control group ($P < 0.05$). Referring to pathological examination, the diagnostic accuracy of chemiluminescence immunoassay was 97.50% (117 / 120), and the difference was not statistically significant ($P > 0.05$). Conclusion: using chemiluminescence immunoassay to detect tumor biomarkers can identify five tumor biomarkers, improve the diagnostic accuracy, and has high clinical value.

Keywords

Chemiluminescence immunoassay; Tumor; Biomarker inspection; Diagnostic accuracy

Under the circumstances of changes in the overall social environment, the incidence of various tumor diseases has been increasing year by year, seriously affecting people's physical health and life safety. In the early stage of some tumors, the clinical symptoms are not typical, which makes patients pay less attention and unable to seek medical treatment and make a diagnosis in time. As the disease progresses, the tumor size gradually increases and may turn into malignancy, which will pose a greater threat to the patient. Based on this, it is necessary to make timely diagnosis and treatment for tumor patients in clinical practice. Although conventional imaging examinations can determine the shape and size of the tumor, they cannot identify its nature, which is not conducive to the development of subsequent treatment. With the deepening of biomedical research, it is believed in clinical practice that the cellular biochemical metabolism and properties of tumor patients will show specific reactions, which are mainly manifested as: abnormal increase of tumor markers in tissues, excretions and body fluids [1]. Therefore, in practice, the detection of tumor markers in serum can be used to screen out early tumor patients and high-risk groups, and then identify the nature and development of tumors in time, providing a reliable basis for clinical work. Currently, tumor biomarker testing technologies are becoming increasingly sophisticated, with chemiluminescence immunoassay being a relatively

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typical method, possessing high sensitivity, specificity, and accuracy. This study compared the specific outcomes of tumor biomarker testing using chemiluminescence immunoassay in 120 cancer patients and 120 healthy individuals admitted to our hospital. The details are reported below.

1. General Information and Methods

1.1 General Information

Among the cancer patients admitted to our hospital from June 2020 to June 2021, 120 cases were selected as the observation group, including 34 cases of lung cancer, 21 cases of ovarian cancer, 30 cases of liver cancer, 10 cases of breast cancer, and 25 cases of gastric cancer. There were 56 male patients and 64 female patients. The oldest patient was 76 years old and the youngest was 33 years old, with a mean age of (55.38±8.39) years. During the same period, 120 healthy individuals who underwent physical examinations at our hospital were selected as the control group, including 55 male patients and 65 female patients. The oldest patient was 75 years old and the youngest was 32 years old, with a mean age of (55.68±8.53) years.

Inclusion criteria: (1) All patients in the observation group were diagnosed with tumors by pathological examination [2]; (2) All patients in the control group were healthy, had no history of tumors, and had not taken any drugs that would affect them recently; (3) All subjects in both groups were informed about this study and signed consent forms.

After comparing the age and gender of the two groups of subjects, it was determined that $P > 0.05$, indicating they were comparable.

1.2 Methods

After identifying the subjects, they were instructed not to eat after dinner one day prior to the examination and to ensure sufficient sleep. For chemiluminescence immunoassay, 4 mL of fasting venous blood was collected from each subject the following morning as the research sample, and then placed in a biochemistry tube for storage. The sample was then centrifuged at 3000 rpm for 15 minutes to obtain serum. A Siemens Centaur XP chemiluminescence analyzer was used to perform the examination, clarifying the levels of several indicators in the patient's serum, including carcinoembryonic antigen (CEA), carbohydrate antigen 199 (CA199), carbohydrate antigen 153 (CA153), alpha-fetoprotein (AFP), and carbohydrate antigen 125 (CA125).

1.3 Evaluation Indicators

The normal range for AFP is 0~7 ng/mL; the normal range for CA199 is 0~37 U/L; the normal range for CA125 is 0~40 U/L; CEA is ≤6.5 ng/mL for smokers and ≤5 ng/mL for non-smokers; CA153 is <25 U/mL [3] .

1.4 Statistical Analysis

Data were analyzed using SPSS 18.0 statistical software. $\bar{x} \pm s$ Measurement data were expressed as ( ) and analyzed by t-test; count data were expressed as percentages (%) and analyzed by χ^2 *test* . $P < 0.05$ was considered statistically significant.

2. Results

2.1 Comparison of Tumor Biomarker Indicators

Table 1. Comparison of tumor biomarker levels between the two groups of subjects ($\bar{x} \pm s$)

index	Observation group (n=120)	Control group (n=120)
CEA (ng/L)	83.42±10.82	17.68±3.45
CA199 (U/L)	438.48±63.49	183.59±53.10
CA153 (U/L)	500.32±100.29	245.39±48.93
AFP (ng/L)	1027.37±340.28	787.32±65.67
CA125 (U/L)	524.23±88.39	245.39±45.38

There were significant differences in CEA, CA199, CA153, AFP, and CA125 levels between the observation group and the control group ($P < 0.05$), with the former being significantly higher. See the table below for details.

2.2 Comparison of Diagnostic Accuracy

Based on pathological examination, the diagnostic accuracy of chemiluminescence immunoassay was 97.50% (117/120), with no statistically significant difference ($P > 0.05$). See the table below for details.

Table 2. Comparison of diagnostic accuracy between pathological examination and chemiluminescence immunoassay (n, %)

Group	Number of examples	Diagnostic accuracy	Misdiagnosis rate
Observation group	120	117 (97.50)	3 (2.50)
control group	120	120 (100.00)	0

3. Discussion

In the context of the integration and development of medicine and biology, tumor biomarker testing has become a commonly used clinical diagnostic method for tumor diseases. The presence and quantitative changes of tumors can reflect the nature of tumors, thereby understanding the differentiation and function of tumor tissue cells, and classifying, classifying and treating them [4]. Chemiluminescence immunoassay is a common tumor biomarker testing method. Although it has been applied in laboratory medicine, it still lacks patient acceptance. With the continuous improvement of this technology, its accuracy has also increased. In the process of implementation, the accuracy of tumor marker detection is high and the application effect is ideal. As a test method with less pollution, good specificity, convenient operation and high accuracy, chemiluminescence immunoassay has a relatively ideal effect on virus, tumor markers, immune system and cardiac function monitoring [5]. This test method is a new method improved on the basis of radioimmunoassay and enzyme-linked immunosorbent assay. It has no radioactive elements and teratogenic substances and has high safety [6]. Especially in recent years, the application of nanomaterials has been continuously promoted, which has made the application effect of chemiluminescence immunoassay in the detection of tumor biomarkers more effective [7]. Compared with conventional radiological examination, it has the characteristics of less trauma; compared with simple imaging examination, it can clarify the nature and degree of tumors, which is more helpful for clinical work. This is mainly because chemiluminescence immunoassay enhances the luminescence effect through catalysts and luminescent substances, so that the accuracy of the test can be guaranteed. AFP is mainly synthesized in the fetal liver, and is close to the adult level (less than 30 ng/mL) at one year of age. In adults, AFP can be elevated in the serum of about 80% of liver cancer patients and 50% of germ cell tumors, and can also be elevated to varying degrees after liver metastasis of other tumors [8]. CEA is a substance that can be divided by polyacrylamide gradient gel electrophoresis and exists in a variety of malignant tumor diseases [9]. CA125 is a marker of epithelial ovarian cancer and endometrial cancer. The CA125 content of patients with serous endometrioid carcinoma, clear cell carcinoma, fallopian tube cancer and undifferentiated ovarian cancer can be significantly elevated [10]. CA15-3 levels were significantly elevated in breast cancer patients, and it is also the best indicator for monitoring postoperative recurrence in breast cancer patients. CA19-9 is a biomarker for pancreatic cancer and colorectal cancer. In this study, the control group consisted of healthy individuals, while the observation group consisted of cancer patients. Comparisons of AFP, CEA, CA125, CA153, and CA199 levels between the two groups showed that the observation group had significantly higher levels than the control group ($P < 0.05$). Furthermore, all patients in the observation group underwent pathological examination and were diagnosed with cancer. After chemiluminescence immunoassay (CIA) testing, the diagnostic accuracy rate was as high as 97.50%, with a false negative or missed diagnosis rate of 2.50%, demonstrating the significant effectiveness of CIA in the auxiliary diagnosis and differential diagnosis of cancer. Because this examination method is minimally invasive, largely unaffected by sample destruction or hemolysis, and can screen for multiple cancers simultaneously, coupled with automated equipment, CIA is highly favored in cancer screening and diagnosis.

In conclusion, using chemiluminescence immunoassay for tumor biomarker testing can help improve the accuracy of clinical diagnosis and has high clinical application value.

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