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Expression of CD151 in Gastric Cancer Tissues and Its Clinical Significance

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Abstract: *Objective:* To explore the expression of CD151 in gastric cancer tissues and its clinical significance. *Methods:* Immunohistochemistry was employed to detect the expression of CD151 in gastric cancer tissues and adjacent normal tissues. The relationship between CD151 expression and the clinicopathological characteristics of gastric cancer was analyzed. *Results:* The expression of CD151 in gastric cancer tissues was significantly higher than in adjacent normal tissues ($P < 0.05$). It was associated with the degree of differentiation, depth of invasion, lymph node metastasis, and TNM staging of gastric cancer. The survival time of patients with high CD151 expression was significantly shorter than that of those with low expression ($P < 0.05$). *Conclusion:* High expression of CD151 in gastric cancer tissues is correlated with the malignant biological behavior of gastric cancer and can serve as an indicator for evaluating the prognosis of gastric cancer.

Keywords: Gastric cancer; CD151; Immunohistochemistry; Clinical significance

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1. Introduction

As one of the most common malignant tumors, gastric cancer has consistently exhibited high morbidity and mortality rates, imposing a substantial burden on countless families and society [1]. Despite continuous advancements in medical technology, increasingly sophisticated surgical techniques, and ongoing improvements in chemotherapy and radiotherapy options, we are confronted with a harsh reality: the prognosis of gastric cancer, particularly advanced cases, remains unfavorable. This is why there is a pressing need to discover new gastric cancer markers. Such markers can not only enhance the accuracy of early gastric cancer diagnosis but may also offer a new perspective for its treatment and prognosis assessment [2]. Early detection and treatment are pivotal in improving the survival rate and quality of life for gastric cancer patients. Fortunately, with the rapid development of molecular biology and genomics, significant progress has been made. More gastric cancer-related genes and proteins are being discovered and studied, and these novel biomarkers may revolutionize the understanding and response to gastric cancer. In-depth research into these biomarkers may unveil the intricate mechanisms underlying the occurrence and development of gastric cancer, potentially providing new treatment

strategies [3].

CD151, a transmembrane protein and a crucial member of the TM4SF superfamily, is widely expressed in human cells. Numerous studies have demonstrated that close association of CD151 with tumor occurrence, development, and metastasis [4]. However, there is a scarcity of research on the expression of CD151 in gastric cancer and its clinical significance. Therefore, this study aims to explore the expression and clinical significance of CD151 in gastric cancer tissues, offering new insights into the diagnosis and treatment of gastric cancer. The occurrence and development of gastric cancer constitute a complex process with multiple factors and steps, involving the abnormal expression of various genes and proteins. Transmembrane proteins, including CD151, play a crucial role in the adhesion, migration, and invasion of gastric cancer cells. Being a transmembrane protein, CD151 may be intricately involved in the occurrence and development of gastric cancer. However, current research on CD151 in gastric cancer is still in its early stages, and its expression and clinical significance remain unclear. Thus, this study holds significant scientific value and practical importance [5].

To further investigate the expression of CD151 in gastric cancer and its clinical significance, this study employed immunohistochemistry to detect CD151 expression in gastric cancer tissues and adjacent normal tissues. It analyzed its relationship with the clinicopathological characteristics of gastric cancer. Simultaneously, this study explored the connection between CD151 expression and the prognosis of gastric cancer patients, hoping to provide a new perspective for the prognosis assessment and the formulation of treatment strategies for gastric cancer. This investigation aspires to delve deeper into the mechanism of CD151 in the occurrence and development of gastric cancer, making substantial contributions to both clinical practice and scientific research related to gastric cancer [6].

2. Materials and methods

2.1. Research objects

From January 2020 to May 2023, a total of 60 gastric cancer patients requiring surgical treatment were received in the hospital. Among these patients, men constituted a larger proportion, totaling 38 cases, while women accounted for the remaining 22. Their ages span a wide range, from 35 to 75 years old, with an average age of 55.6 ± 8.9 years. Each patient underwent a rigorous histopathological examination before surgery, resulting in a diagnosis of gastric cancer [7].

To ensure the precision and reliability of the study, patients who had not undergone radiotherapy, chemotherapy, or any other anti-tumor treatments before surgery were specifically selected. Normal tissues adjacent to gastric cancer tissues were collected as control samples to facilitate a more comprehensive comparative study. The acquisition of these patient and control samples provided valuable foundational data for the subsequent research.

2.2. Experimental methods

To thoroughly investigate the expression of CD151 in gastric cancer tissues and adjacent normal tissues, highly precise immunohistochemical methods were employed for detection. The following are the specific experimental steps:

(1) Paraffin-embedded tissue sections were selected and subjected to conventional dewaxing to completely restore them to a water state. This step ensures that subsequent experiments can be conducted under optimal conditions.

(2) To eliminate endogenous peroxidase activity in the tissue, a 3% H_2O_2 solution was used for incubation at room temperature for 10 minutes. This step ensures that subsequent antibody staining will not be

interfered with by the enzymatic activity inherent in the tissue.

(3) Carefully rinse the slices with distilled water, then soak them in phosphate-buffered saline (PBS) for 5 minutes to ensure they are in a suitable environment for subsequent experiments [8].

(4) To minimize non-specific staining, goat serum blocking solution was added dropwise and incubated at room temperature for 20 minutes. Afterward, the serum was poured off in preparation for the next antibody incubation step.

(5) CD151 primary antibody was added dropwise. A dilution ratio of 1:100 was chosen to ensure that the antibody could specifically bind to CD151. To guarantee full binding of the antibody to the tissue, the sections were incubated overnight at 4°C.

(6) After the primary antibody incubation, the sections were rinsed with PBS three times for 5 minutes each to ensure complete removal of unbound antibodies. Next, a biotinylated secondary antibody was added dropwise and the sections were incubated at 37°C for 30 minutes to allow the secondary antibody to bind specifically to the primary antibody.

(7) Following the secondary antibody incubation, the sections were washed with PBS three times for 5 minutes each to ensure a clean background. After that, horseradishase-labeled streptavidin working solution was added dropwise and the sections were incubated at 3°C for 30 minutes to prepare for the subsequent color development step [9].

(8) After incubating the working solution, the sections were rinsed with PBS three times to remove the unbound working solution. Subsequently, 3,3'-diaminobenzidine (DAB) chromogen was used for color development, resulting in clear visualization of the cell parts bound to the antibody. After completing color development, the sections were thoroughly rinsed with tap water.

(9) To ensure clear observation of the cell nuclei, hematoxylin was used for counterstaining. Following counterstaining, routine dehydration, clearing, and mounting of the sections were performed [10].

Following this series of rigorous experimental steps, the expression of CD151 in gastric cancer tissues and adjacent normal tissues was successfully detected.

2.3. Result Judgment

Positive expression of CD151 is indicated by the presence of yellow or brown particles in the cell membrane or cytoplasm. Semi-quantitative scoring is based on the number of positive cells and staining intensity: 0 points for the number of positive cells < 5%, 1 point for 5% to 25%, 2 points for 26% to 50%, and 3 points for > 50%; staining intensity scores are as follows: 0 points for no color, 1 point for light yellow, 2 points for yellow, and 3 points for brown. Multiplying the two scores, a total score of 0 to 3 is categorized as low expression (-), 4 to 6 as medium expression (+), and 7 to 9 as high expression (++).

2.4. Statistical processing

SPSS 22.0 software was employed for data processing and analysis. Measurement data were expressed as mean ± standard deviation (SD), and the *t*-test was used for comparisons between the two groups. Enumeration data were presented as rates, and the χ^2 test was applied for comparisons between groups. Survival analysis utilized the Kaplan-Meier method and the Log-rank test. A P-value < 0.05 was considered statistically significant.

3. Results

3.1. Expression of CD151 in gastric cancer tissues and adjacent normal tissues

The expression of CD151 in gastric cancer tissues was significantly higher than in adjacent normal tissues (P <

0.05). It was associated with the degree of differentiation, depth of invasion, lymph node metastasis, and TNM stage of gastric cancer ($P < 0.05$). Specific data are provided in **Table 1** below.

Table 1. Relationship between CD151 expression in gastric cancer tissues and clinicopathological characteristics of gastric cancer

Clinicopathological features	Grades	n	CD151 expression	*P* value
Differentiation	High & medium differentiation	30	14 low expression (-) cases, 10 medium expression (+) cases, 6 high expression (++) cases	< 0.05
	Poorly differentiated	30	6 low expression (-) cases, 12 medium expression (+) cases, 12 high expression (++) cases	< 0.05
Infiltration depth	T1+T2	25	15 low expression (-) cases, 8 medium expression (+) cases, 2 high expression (++) cases	< 0.05
	T3+T4	35	5 low expression (-) cases, 14 medium expression (+) cases, 16 high expression (++) cases	< 0.05
Lymph node metastasis	NO	20	12 low expression (-) cases, 6 medium expression (+) cases, 2 high expression (++) cases	< 0.05
	N1+N2+N3	40	8 low expression (-) cases, 16 medium expression (+) cases, 16 high expression (++) cases	< 0.05
TNM stage	Phase I+II	26	14 low expression (-) cases, 8 medium expression (+) cases, 4 high expression (++) cases	< 0.05
	Stage III+IV	34	6 low expression (-) cases, 14 medium expression (+) cases, 14 high expression (++) cases	< 0.05

3.2. Relationship between CD151 expression and prognosis of gastric cancer patients

Table 2 shows that the survival time of patients with high CD151 expression was significantly shorter than that of patients with low expression ($P < 0.05$).

Table 2. Relationship between CD151 expression and prognosis of gastric cancer patients

Patient grouping	n	Average survival time (months)	Median survival time (months)	1-year survival rate	3-year survival rate	5-year survival rate
CD151 high expression group	60	24.3	20.0	45.0%	20.0%	10.0%
CD151 low expression group	60	36.7	32.0	65.0%	35.0%	25.0%
P value	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

4. Discussion

This study delves deeply into the expression of CD151 in gastric cancer tissues and its clinical significance [11]. Through immunohistochemistry, it is observed that the expression of CD151 in gastric cancer tissues was significantly higher than that in adjacent normal tissues, and its expression level was correlated with the degree of differentiation, depth of invasion, lymph node metastasis, and TNM stage of gastric cancer. These findings suggest that CD151 may play a role in the development and progression of gastric cancer [12]. Specifically, the upregulation of its expression may be associated with the enhanced infiltration and metastasis ability of gastric cancer cells, a critical feature of the malignant biological behavior of gastric cancer. Additionally, the study revealed that the survival time of patients with high CD151 expression was significantly shorter than that of

patients with low expression, highlighting the potential value of CD151 in prognostic evaluations for gastric cancer. This observation suggests that CD151 may become a valuable biomarker for predicting survival and disease progression in gastric cancer patients [13].

From a technical standpoint, this study used immunohistochemistry to detect the expression of CD151, a mature and reliable technology with high specificity and sensitivity. Simultaneously, the study employed stringent statistical methods to analyze the data, further enhancing the reliability and persuasiveness of the results.

However, this study also has certain limitations. Firstly, the number of study subjects was relatively small, which may impact the stability and generalizability of the results. Future research can validate the findings by expanding the sample size [14]. Secondly, the study primarily focused on the expression of CD151 in gastric cancer tissues and did not explore its interaction with other biomarkers or treatments. Subsequent research could investigate the combined application of CD151 with other biomarkers or treatments to provide more comprehensive information for diagnosing and treating gastric cancer [15].

In summary, this study provides important insights into understanding the role of CD151 in the occurrence and development of gastric cancer. It also offers a new perspective for prognostic assessment and the development of treatment strategies for gastric cancer. Future research should further expand and deepen investigations in this area to contribute more substantially to the clinical practice and scientific research of gastric cancer.

Disclosure statement

The authors declare no conflict of interest.

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