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PROGNOSTIC SIGNIFICANCE OF EGFR AND VEGF RECEPTORS IN COLORECTAL CANCER RECURRENCE PREDICTION

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Abstract

The aim of this study was to evaluate the role of growth factor receptors EGFR and VEGF in predicting recurrence of colorectal cancer. The analysis included 103 tissue samples from patients treated at an oncology center between 2016 and 2022. Immunohistochemical methods were used to assess the expression of EGFR and VEGF, and their association with recurrence or non-recurrence was analyzed. The results demonstrated that positive receptor status was significantly associated with an increased likelihood of recurrence (p=0,018 for EGFR and p=0,001 for VEGF). Odds ratio analysis confirmed that negative status of these markers reduces the risk of recurrence. The findings suggest that EGFR and VEGF have high prognostic value and potential as therapeutic targets in personalized treatment of colorectal cancer. The article emphasizes the need for further research to confirm and expand the application of these biomarkers in clinical practice.

Keywords: *Colorectal cancer, EGFR, VEGF, recurrence, prognostic markers*

Introduction

Colorectal cancer (CRC) is one of the leading malignancies worldwide and poses a significant healthcare challenge due to its high morbidity and mortality rates (Ferlay et al., 2019). Despite advances in diagnostics and therapy, disease recurrence remains a significant barrier to improving treatment outcomes (Van Cutsem et al., 2020). Therefore, identifying reliable prognostic markers capable of predicting tumor clinical behavior is a pressing challenge in modern oncology (Menter et al., 2019).

Growth factor receptors, such as epidermal growth factor receptor (EGFR) and vascular endothelial growth factor (VEGF), play a key role in carcinogenesis, including tumor growth and metastasis (Morgillo et al., 2017). EGFR is involved in the regulation of cell proliferation and survival, and its overexpression correlates with the aggressive course of many cancers, including colorectal cancer (Yonesaka et al., 2018). Similarly, VEGF promotes angiogenesis, which is critical for the nutrition and growth of rapidly growing tumors (Abdollahi et al., 2018).

While the role of these receptors in the pathogenesis of colorectal cancer is actively studied, a deeper understanding of their prognostic significance remains necessary. The present study aimed to investigate the relationship between EGFR and VEGF status and the risk of recurrence in patients with colorectal cancer (Jubb et al., 2020). We hypothesize that positive status of these receptors is associated with an increased likelihood of recurrence, thereby confirming their value as therapeutic targets and prognostic markers (Miller et al., 2021).

The aim of the study is to evaluate EGFR and VEGF expression as potential markers of disease progression, which may facilitate the development of more personalized treatment approaches and improved clinical outcomes in patients with colorectal cancer.

Materials and Methods

This dissertation is based on an analysis of 103 patients treated at the Russian Scientific and Practical Medical Center of Oncology and Radiology from 2016 to 2022.

Inclusion Criteria:

1. Patients aged 18 years and older;
2. Confirmed diagnosis of colorectal cancer based on histological examination;
3. Presence or absence of lymph node metastases based on preoperative or surgical examination.

Exclusion Criteria:

1. History of other malignancies or significant comorbidities that may affect study results;
2. Stage IV disease.
3. Patients with incomplete information about the primary tumor, lymph node status, or treatment history.

Study Design and Sample

This study was designed as a retrospective analysis aimed at assessing the prognostic value of EGFR and VEGF growth factor receptors in patients with colorectal cancer. Tissue samples from patients treated at our oncology center between 2020 and 2024 were collected for analysis. Only patients with complete clinical information, including data on disease recurrence and expression levels of the receptors under study, were included.

Immunohistochemical Assessment

EGFR and VEGF expression in tumor tissue samples was assessed using immunohistochemical staining. Antibodies specific to EGFR and VEGF were used in accordance with the protocols provided by the manufacturers. Expression levels were assessed by two independent pathologists blinded to patient clinical information, thereby eliminating bias in the interpretation of results. A positive tumor was defined as intense staining in more than 10% of tumor cells.

Statistical Analysis

Statistical analysis was performed using SPSS software (version XX). The chi-square test and Fisher's exact test were used to compare the frequencies of positive and negative receptor statuses in the recurrence and non-recurrence groups. Differences were considered significant at a p-value of less than 0.05. Odds ratios for receptor negativity were calculated to estimate the likelihood of recurrence in the corresponding patient subgroups.

Results. We analyzed growth factor receptors, such as EGFR and VEGF, in relation to the presence or absence of recurrence in patients with colorectal cancer. The results of the analysis show significant statistical differences, highlighting the importance of these receptors as prognostic factors.

Table 1. *Analysis of growth factor receptors depending on relapse*

Indicators	Category	recurence (yes-1, no 0)		p
		absence of relapse	Presence of relapse	
EGFR	EGFR positive	25 (52,1)	41 (74,5)	0,018*
	EGFR negative	23 (47,9)	14 (25,5)	
VEGF	VEGF positive	24 (50,0)	44 (80,0)	0,001*
	VEGF negative	24 (50,0)	11 (20,0)	

** – the differences in the indicators are statistically significant (p < 0,05)*

EGFR (Epidermal Growth Factor Receptor) is a key receptor that plays a vital role in regulating cell growth, division, and survival. Its activation is associated with various mechanisms of carcinogenesis, including stimulation of tumor cell proliferation, invasiveness, and angiogenesis. EGFR expression is elevated in many tumors, including colorectal cancer, and is associated with more aggressive forms of the disease and worse clinical outcomes. Studies have shown that EGFR positivity correlates with an increased likelihood of metastasis and recurrence, which is confirmed by our data: 74.5% of patients with relapse were EGFR positive, while only 52.1% of patients without relapse were EGFR positive. Statistically significant differences with a p-value of 0.018 highlight the importance of monitoring EGFR levels when planning therapy. Since EGFR is a target for various targeted therapies, the study results indicate the potential clinical significance of this receptor for personalized treatment of colorectal cancer.

VEGF (Vascular Endothelial Growth Factor), in turn, is a key factor regulating angiogenesis—the process of forming new blood vessels from existing ones. This is particularly important for tumors, as they require and enhance vascularity for growth and spread. Increased VEGF expression is associated with tumor aggressiveness and poor survival rates. The results of our analysis show that 80.0% of patients with relapse have a positive VEGF status, compared with 50.0% of patients without relapse (p=0.001). These data highlight the association between high VEGF status and disease recurrence, suggesting that angiogenesis may be an important mechanism in colorectal cancer progression. Given these results, VEGF may serve not only as a prognostic marker but also as a potential target for therapies aimed at inhibiting angiogenesis, thereby limiting tumor growth and metastasis.

A comparative analysis of the odds ratios for EGFR and VEGF statuses shows that negative status of these receptors reduces the likelihood of recurrence in patients with colorectal cancer. The odds of EGFR-negative tumors in the recurrence group were 2.694 times lower, while for VEGF-negative tumors in the same group, the odds were 4.000 times lower. These significant differences highlight how biological markers can predict tumor behavior and recurrence.

Thus, these data highlight the importance of EGFR and VEGF as prognostic markers in clinical practice, as well as their potential as targets for new therapies in the management of colorectal cancer. Research into these factors could provide the basis for developing more effective and personalized treatment approaches that can improve quality of life and patient survival. Further in-depth studies are needed to confirm these findings and identify optimal treatment strategies based on tumor marker characteristics.

Conclusion

This study confirmed a significant association between the expression of the growth receptors EGFR and VEGF and the risk of colorectal cancer recurrence. The statistically significant differences detected indicate the high prognostic value of these biomarkers for assessing the likelihood of disease recurrence. Their use in clinical practice may facilitate more accurate patient stratification and the selection of personalized therapeutic strategies aimed at reducing the risk of recurrence and improving survival. Further multicenter and prospective studies are needed to confirm these findings and develop standards for the use of these markers in oncology practice.

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