Original Article

Stromal CD10 as a Tumor Microenvironment Immunomarker in Colorectal Carcinoma: Association with Clinicopathological Parameters

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Abstract

Background: *Colorectal carcinoma (CRC) is the third most common malignancy worldwide, posing a major public health challenge. Tumor-stromal interactions are increasingly recognized as potential therapeutic targets. CD10 has been implicated in tumor aggressiveness, with altered expression linked to the development of various cancers. This study aimed to evaluate stromal CD10 expressions in colorectal carcinoma and its association with clinicopathological parameters.* ***Materials and Methods:*** *A cross-sectional observational study was conducted on 50 colorectal carcinoma cases at the Department of Pathology, Dhaka Medical College, from March 2022 to February 2024. Purposive sampling was used, and immunohistochemistry for stromal CD10 expression was performed. Formalin-fixed, paraffin-embedded tissue from histologically confirmed cases was analyzed. Data was entered, cleaned, and analyzed using SPSS version 25.0.* ***Results:*** *Tumors were most frequently located in the left colon (58%), with a mean size of 5.1±2.8 cm; 72% showed exophytic growth, and most were staged as T3 (42%). Nodal metastasis and lymphovascular invasion were observed in 50% and 28% of cases, respectively, while 70% were low grade. Stromal CD10 expression was detected in 48% of tumors. Higher CD10 positivity was seen among patients aged 41-60 years, females, and smokers. Although no significant associations were found with most tumor parameters, CD10 expression was significantly associated with lymphovascular invasion (71.4% vs. 38.9%, p<0.05).* ***Conclusion:*** *The findings of this study suggest that stromal CD10 may have a role in colorectal carcinoma progression, particularly in relation to lymphovascular invasion.*

Keywords: Clinicopathological parameters, CD10, Colorectal cancer, Stromal expression.
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Introduction

Colorectal carcinoma (CRC) ranks as the third most frequently identified cancer globally and stands as the second leading cause of cancer-associated fatalities worldwide[1]. The anticipated rise in the global incidence of colorectal carcinoma is projected to elevate from 1.8 million new cases annually to 2.2 million by the year 2030[2]. In Bangladesh, colorectal cancer ranks 7th in prevalence and 10th in cancer-related mortality[3]. CRC commonly presents with altered bowel habits, blood in stool, abdominal discomfort, unexplained weight loss, fatigue, and a persistent sense of incomplete evacuation[2]. Its risk increases with age, particularly after 50, and is further influenced by genetic predispositions (e.g., Lynch syndrome, FAP), a personal history of inflammatory bowel disease, and familial occurrence. Lifestyle factors- including a diet rich in red and processed meats, low fiber intake, physical inactivity, obesity, and use of tobacco or alcohol- also significantly contribute to disease susceptibility[4]. CRC is classified based on cellular origin and tumor characteristics. Adenocarcinoma accounts for over 90% of cases, while less common types include carcinoid tumors, gastrointestinal stromal tumors (GISTs), lymphomas, and sarcomas[5]. The World Health Organization (WHO) currently classifies colorectal adenocarcinoma into low-grade (formerly well to moderately differentiated) and high-grade (formerly poorly differentiated) tumors. This simplified system is clinically relevant, as low-grade tumors generally carry a more favorable prognosis, while high-grade tumors exhibit aggressive behavior and poorer outcomes[6]. Previously, WHO categorized

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colorectal adenocarcinoma into three histological grades based on glandular differentiation: Grade 1 (well-differentiated), with >95% gland formation and close resemblance to normal epithelium, associated with favorable prognosis; Grade 2 (moderately differentiated), showing 50-95% glandular differentiation with partial architectural distortion; and Grade 3 (poorly differentiated), characterized by <50% gland formation, marked atypia, and aggressive clinical behavior[7].

At the time of diagnosis, over 20% of patients present with metastatic (stage IV) CRC.[8] The exact mechanisms underlying cancer metastasis remain elusive, yet research indicates that it arises from intricate interactions between tumor cells and their surrounding tumor microenvironment[9]. Many molecules are secreted by tumor cells or by stromal cells facilitate tumor invasion and metastasis[10]. One such molecule is Matrix Metalloproteinase (MMP), that has influence in cancer progression and in defining the role of stromal microenvironment in invasiveness and metastatic potential[11]. MMPs play a multifaceted role in cancer progression by facilitating extracellular matrix degradation, inhibiting apoptosis, promoting angiogenesis, and modulating the immune response, thereby supporting tumor invasion and metastasis[12]. Cluster of Differentiation 10 (CD10) is a membrane-bound, zinc-dependent metalloprotease expressed in epithelial cells of the prostate, colon, liver, stomach, breast, lung, endometrium,[13-15] renal tubular brush borders and various tumor & stromal cells[16].

It plays a pivotal role in peptide metabolism through the degradation of key signaling molecules such as enkephalins, bradykinin, and selected cytokines[17]. Initially identified in leukemia, CD10 has since emerged as a significant immunohistochemical marker in various malignancies, including breast and colorectal carcinomas[18,19]. In CRC, CD10 expression- particularly within stromal cells- has been linked to tumor progression, aggressiveness, and differentiation status[20]. Despite surgical resection being the mainstay of CRC treatment, high recurrence and metastasis rates persist, with nearly 60% of patients affected postoperatively and 20% dying from disease recurrence[21]. Current therapies largely target epithelial tumor cells, often neglecting the genetically stable stromal compartment, which may contribute to therapeutic failure and relapse[10]. Given CD10's expression in tumor-associated stroma, presents a promising diagnostic and therapeutic target. The anti-CD10 monoclonal antibody JMAM-1 has demonstrated antitumor activity in mesothelioma, suggesting potential applications in CRC[22]. This study investigates stromal CD10 expression in CRC and its association with clinicopathological features, aiming to elucidate its role in tumor invasiveness and to explore its viability as a therapeutic target.

Materials and Methods

Study design and settings: This cross-sectional observational study was conducted to evaluate clinicopathological and immunohistochemical parameters in colorectal adenocarcinoma. The study period spanned March 2022 to February 2024 and included 50 patients who underwent colorectal tumor resection at the Department of Surgery, Dhaka Medical College Hospital (DMCH) and were histologically confirmed as colorectal adenocarcinoma. Patients who had received preoperative chemotherapy or radiotherapy, or who presented with completely necrotic or non-carcinomatous tumors, were excluded.

Data collection procedure: Histopathological analysis was performed at the Department of Pathology, Dhaka Medical College, while immunohistochemical (IHC) staining was carried out at Primate Diagnostic Center, Dhaka. Clinical data- including age, gender, education, and family history were collected using structured proformas through patient or attendant interviews and review of hospital records. Tumor-related variables assessed included size, location, growth pattern, grade, depth of invasion, nodal metastasis, and lymphovascular invasion (LVI). Tumor location was classified as right colon (caecum to transverse colon) or left colon (descending colon to rectum). Tumor size was categorized as ≤3 cm, 3.1-6 cm, and >6 cm. Gross morphology was classified as exophytic or endophytic. Tumor grading followed WHO criteria: low grade (well to moderately differentiate) and high grade (poorly differentiated). Depth of invasion was staged T1-T4 according to penetration into surrounding structures. Nodal involvement was recorded as metastatic or non-metastatic, and LVI was documented as present or absent.

Paraffin-embedded tumor blocks were retrieved from archival pathology samples. Sections (4 µm) were stained with hematoxylin and eosin for routine histopathology. For CD10 IHC, antigen retrieval was followed by HRP-based EnVision staining. Stromal CD10 expression was semi-quantitatively scored, with ≥5% positivity considered positive. Tonsil tissue served as the positive control.

Statistical analysis: Data was entered, cleaned, and analyzed using SPSS version 25.0. Descriptive statistics were expressed as frequencies and percentages. The Chi-square ($\chi 2$) test was used to assess associations. A p-value <0.05 at a 95% confidence interval was considered statistically significant.

Ethical approval: Informed written consent was obtained from all participants. Data confidentiality was maintained, and unauthorized access was strictly prohibited. The Ethical approval was obtained from the Ethical Review Committee of Dhaka Medical College, and written informed consent was secured from all participants (Reference: ERC-DMC/ECC/2022/397).

Results

In the Table-I, the study population ranged in age from 14 to 83 years (mean: 50.3±14.3 years) and was stratified into three age groups, with the 41-60-year category representing the majority (54.0%). A slight female predominance was observed (M:F= 1:1.2). A positive family history was reported in 10.0% of cases, while 32.0% had a history of smoking.

Among all colorectal carcinoma cases, tumors were most commonly located in the left colon (58%), including the descending colon, sigmoid colon, and rectum. Tumor size ranged from 1.5 to 13.0 cm, with a mean diameter of 5.1±2.8 cm. More than half (54%) measured 3.1-6.0 cm, while smaller tumors (≤3 cm) occurred in 24% and larger tumors (>6.0 cm) in 22%, indicating relatively fewer cases at the extremes of size. Exophytic growth was the predominant pattern (72%). Most tumors were staged as T3 (42%), followed by T2 (34%) and T4 (24%), with no T1 lesions detected. Nodal metastasis was present in 50% of cases, and lymphovascular invasion in 28%. The majority of tumors were low grade (70%). Stromal CD10 expressions were observed in 48% of cases. (Table-II) The present study examined the association between stromal CD10 expression and clinico-demographic variables. Higher CD10 positivity was observed among patients aged 41-60 years (59.3%), females (51.9%), and smokers (62.5%), whereas lower expression rates were noted in younger individuals, males, and those with a positive family history (Table-III).

Table-IV shows that most associations were statistically non-significant (p>0.05). CD10 expression was evaluated in relation to various tumor parameters in colorectal carcinoma. Higher CD10 positivity was observed in left colonic tumors (51.7%) compared with proximal colonic lesions (42.9%). Tumors measuring 3.1-6.0 cm demonstrated the highest expression (55.6%), while larger tumors (>6.0 cm) showed lower expression (36.4%) (p=0.495). Growth pattern variations were not associated with CD10 expression (p= 0.650). Although CD10 expression was most frequent in T4 lesions (58.3%), the difference across stages was not significant (p=0.670). Cases with nodal metastasis showed slightly higher expression (52.0%) compared with node-negative tumors (44.0%). A statistically significant association was observed with lymphovascular invasion, with 71.4% positivity in LVI-positive cases versus 38.9% in LVI-negative cases (p=0.039). While expression was higher in high-grade tumors (53.3%), no significant association was found across WHO grades (p=0.621).

Table-I: Socio-demographic outlines of cases (n=50)

Characteristics	Frequency (n)	Percentage (%)
Age (years)		
≤40	10	20.0
41-60	27	54.0
>60	13	26.0
Mean±SD	50.3 ±14.3	
Gender		
Male	23	46.0
Female	27	54.0
Family history		
Positive	5	10.0
Negative	45	90.0
History of smoking		
Yes	16	32.0
No	34	68.0

Table-II: Cases according to their tumor parameters (n=50)

Traits	Frequency (n)	Percentage (%)
Tumor location		
Left colon	29	58.0
Right colon	21	42.0
Tumor size		
≤ 3.0 cm	12	24.0
3.1-6.0 cm	27	54.0
> 6.0 cm	11	22.0
Mean ± SD	5.1±2.8	
Growth pattern		
Exophytic	36	72.0
Endophytic	14	28.0
Extent of tumor		
T2	17	34.0
T3	21	42.0
T4	12	24.0
Lymph node metastasis		
Yes	25	50.0
No	25	50.0
Lymphovascular invasion		
Yes	14	28.0
No	36	72.0
Grade of tumor		
Low grade	35	70.0
High grade	15	30.0
Expression of CD10		
Positive	24	48.0
Negative	26	52.0

Table-III: Association of CD10 expression with socio-demographics of the cases (n=50)

Attributes	CD10 expression		p-value
	Positive	Negative	
	n (%)	n (%)	
Age			
≤40	3 (30.0)	7 (70.0)	0.245
41-60	16 (59.3)	11 (40.7)	
>60	5 (38.5)	8 (61.5)	
Gender			
Male	10 (43.5)	13 (56.5)	0.555
Female	14 (51.9)	13 (48.1)	
Family history			
Positive	2 (40.0)	3 (60.0)	1.000
Negative	22 (48.9)	23 (51.1	
Smoking history			
Yes	10 (62.5)	6 (37.5)	0.159
No	14 (41.2)	20 (58.8)	

p-values were obtained by Fisher's exact test

Table-IV: Association of CD10 expression with different clinicopathological parameters of tumor (n=50)

Attributes	CD10 expression		p-value
	Positive	Negative	
	n (%)	n (%)	
Tumor location			
Left colon	15 (51.7)	14 (48.3)	0.536
Right colon	9 (42.9)	12 (57.1)	
Tumor size (in cm)			
≤3.0	5 (41.7)	7 (58.3)	0.495
3.1-6.0	15 (55.6)	12 (44.4)	
> 6.0	4 (36.4)	7 (63.6)	
Tumor growth pattern			
Exophytic	18 (50.0)	18 (50.0)	0.650
Endophytic	6 (42.9)	8 (57.1)	
Tumor extent			
T2	7 (41.2)	10 (58.8)	0.670
T3	10 (47.6)	11 (52.4)	
T4	7 (58.3)	5 (41.7)	
Lymph node metastasis			
Yes	13 (52.0)	12 (48.0)	0.571
No	11 (44.0)	14 (56.0)	
Lymphovascular invasion			
Yes	10 (71.4)	4 (28.6)	0.039
No	14 (38.9)	22 (61.1)	
WHO grading			
Low grade	16 (45.7)	19 (54.3)	0.621
High grade	8 (53.3)	7 (46.7)	

p-values were obtained by Chi Square test

Discussion

This cross-sectional study was conducted to evaluate stromal CD10 expression in colorectal adenocarcinoma and its association with clinicopathological variables. The mean age of patients was 50.3±14.3 years, with 54% in the 41-60 year group, which also demonstrated the highest CD10 positivity (59.3%). These findings are comparable to studies in India, Austria, and Iraq[23,24], but contrast with higher mean ages reported in Iran (60.2±13.9) and Greece (70.9±9.3)[25]. Female patients constituted 54% of the sample and exhibited greater CD10 expression (51.9%) than males (43.5%). Comparable trends were reported in another study in Africa[26], while opposite patterns were observed in UK and Pakistani cohorts[27,28]. Although family history and smoking were not significantly associated with CD10 positivity, a slight reduction in expression was noted among those with a positive family history[29]. Tumor in left colon showing higher CD10 expression (51.7%) compared to proximal ones (42.9%), aligning with findings by Granados-Romero et al. (2017).[30] The mean tumor size was 5.1±2.8 cm, with CD10 positivity peaking in tumors sized 3.1-6.0 cm, similar to finding the studies[31,32].

Current study found positivity of stromal CD10 expression higher (50%) in tumors with exophytic growth patterns while lower (42.9%) in tumor with endophytic growth pattern, suggesting a correlation between CD10 and protruding morphology[33,34]. Stromal CD10 expression increased with tumor depth, highest in T4 lesions (58.3%), and was more frequent in cases with lymph node metastasis (52%) and lymphovascular invasion (71.4%, p= 0.039). CD10 was positive in 48% of cases. Its absence in adjacent non-neoplastic mucosa suggests a role in tumor microenvironment remodeling, cellular signaling disruption[34] and disease progression[7], indicating its potential prognostic significance in colorectal carcinoma.

Conclusion

Stromal CD10 expression was observed in nearly half of colorectal adenocarcinoma cases and showed a significant association with lymphovascular invasion, suggesting a potential role in tumor aggressiveness. No significant correlation was found with other clinicopathological parameters. Assessment of stromal CD10 may aid in identifying tumors with higher invasive potential. Larger, multicenter studies are recommended to further validate its prognostic significance and potential as a therapeutic target.

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Conflict of interest

The authors declared that they have no conflicts of interest.

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