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Original Research Article

Correlation between Glasgow prognostic score and tumor-node-metastasis staging in colorectal cancer

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ABSTRACT

Background: Colorectal cancer (CRC) prognosis is closely linked to clinical stage, with early-stage CRC offering better survival. This study aims to evaluate the relationship between the Glasgow prognostic score (GPS) and tumor-node-metastasis (TNM) staging in CRC. The aim of the study was to evaluate the relationship between the GPS and TNM staging in colorectal cancer
Methods: This cross-sectional study, conducted from June 2018 to May 2019 in the Department of Surgery at Dhaka Medical College Hospital (DMCH), Dhaka, Bangladesh, included 100 colorectal cancer patients. It assessed the correlation between GPS and TNM staging. Data on demographics, tumor site, GPS, and TNM stage were analyzed using Chi-square tests in statistical package for the social sciences (SPSS) version 22.0, with significance set at $p<0.05$.
Results: The study included 100 participants, predominantly male (59%), with a mean age of 65±10 years. The most common tumor sites were the left colon (42%) and rectum (29%). Elevated CRP levels (>10 mg/l) were observed in 25% of participants, and 34% had low albumin levels (≤35 g/l). Most participants had a GPS of 0 (56%), with 29% and 15% having GPS 1 and 2, respectively. Half of the participants were classified as TNM stage III, and 26% as stage IV. Higher GPS values significantly correlated with advanced TNM stages ($p=0.0123$).
Conclusions: The study demonstrated a significant relationship between the GPS and TNM staging in colorectal cancer, highlighting GPS as a potential tool for assessing disease progression.

Keywords: Glasgow prognostic score, TNM staging, Colorectal cancer, Systemic inflammation, Prognostic markers

INTRODUCTION

Colorectal cancer (CRC) ranks as the third most prevalent cancer worldwide and stands as the second leading cause of cancer-related mortality, with approximately 1.8 million new cases and 0.86 million deaths reported in 2018.[1] Globally, it is the second most common cancer in women and the third in men, with mortality rates alarmingly rising among individuals under 55 years since the mid-2000s.[2] While advancements in surgical techniques and adjuvant chemotherapy have improved outcomes, the prognosis for advanced-stage CRC remains poor, with long-term survival rates remaining unsatisfactory. The disease's progression and prognosis are closely linked to its clinical stage and metastasis status, with early-stage CRC offering a five-year survival rate exceeding 90%, compared to just 12% for cases with distant metastases.[3] Both hereditary and sporadic CRC share a pathogenesis heavily influenced by chronic inflammation, underscoring the complexity of the disease and the challenges associated with its prognosis and treatment decisions.[4]

Tumor-node-metastasis (TNM) staging serves as the gold standard for evaluating the stage of colorectal cancer (CRC), providing critical guidance for prognosis and treatment planning. However, TNM staging alone fails to account for the biological and inflammatory characteristics of CRC, as significant variability in clinical outcomes is often observed among patients with the same stage.[5] This highlights the need for supplementary prognostic tools that

integrate biomarkers and markers of systemic inflammation to improve the precision of outcome prediction and enable more personalized treatment strategies.[6,7] Despite these limitations, TNM staging remains an essential tool in clinical practice, offering a foundation for treatment decisions and patient management.

Systemic inflammation plays a crucial role in the prognosis of cancer, with several laboratory biomarkers being explored for their link to cancer progression and survival outcomes. These biomarkers encompass indicators of nutritional and immune status, such as the prognostic nutritional index (PNI), systemic inflammatory response (SIR) markers, and the Glasgow prognostic score (GPS).[3] SIR markers like the neutrophil/lymphocyte ratio (NLR), platelet/lymphocyte ratio (PLR), and lymphocyte/monocyte ratio (LMR) are valuable in assessing immune function in cancer patients.[8-12] Elevated C-reactive protein (CRP), a well-known marker of systemic inflammation, has also been identified as a risk factor for CRC, highlighting the significant role of inflammation in cancer development.[13] In CRC, inflammation-driven pathways involving interleukin (IL)-6, tumor necrosis factor-alpha (TNF-α), and IL-1β are recognized as independent prognostic factors influencing CRC progression and metastasis.[14,15] These inflammatory markers emphasize the critical role of inflammation in cancer prognosis and suggest that incorporating these factors into clinical practice may improve patient outcomes.

The GPS has emerged as a significant inflammation-based prognostic tool, combining serum CRP and albumin (ALB) levels to assess cancer prognosis.[16,17] Elevated GPS scores have consistently been associated with poorer outcomes across various cancers, including CRC.[18-20] In particular, GPS has shown promise in the postoperative prognostication of patients with advanced CRC.[21] While numerous studies have emphasized the relevance of GPS, its full potential is still being explored, especially in predicting outcomes for patients with early-stage CRC. GPS not only reflects the nutritional and immune status of patients but also provides a simpler alternative to more complex prognostic systems. Despite its usefulness, no study has yet integrated GPS with other inflammatory markers such as the PNI and SIR to enhance the current TNM staging system. Such integration could offer deeper insights into cancer prognosis and help refine treatment strategies.

The purpose of this study was to evaluate the relationship between the GPS and TNM staging in CRC. Given the increasing recognition of systemic inflammation as a critical factor in cancer prognosis, the study aimed to explore how GPS, which combines serum CRP and albumin levels, correlates with the traditional TNM staging system. By investigating this relationship, the study sought to assess the potential utility of GPS in providing additional prognostic information, particularly for patients with CRC, and to explore its role in evaluating the inflammatory response and its impact on disease progression.

Objective

The aim of the study was to evaluate the relationship between the GPS and TNM staging in colorectal cancer.

METHODS

This cross-sectional study was conducted in the Department of Surgery at Dhaka Medical College Hospital (DMCH), Dhaka, Bangladesh, from June 2018 to May 2019. A total of 100 colorectal cancer patients were included in the study, evaluating the relationship between the GPS and TNM staging.

Inclusion criteria

Patients diagnosed with colorectal cancer and undergoing treatment at DMCH, individuals with a known TNM stage for their disease, and patients who provided written informed consent for participation in the study were included.

Exclusion criteria

Patients with incomplete medical records or missing TNM stage information, individuals with concurrent malignancies, and patients with conditions that could affect the GPS (such as active infections or significant inflammatory diseases) were excluded.

Written informed consent was obtained from all participants to ensure confidentiality and ethical compliance. Clinical data, including age, sex, tumor site, GPS, and TNM stage, were collected from patient records. GPS was calculated based on CRP and albumin levels, with a score of 0 indicating normal CRP and albumin, 1 indicating either elevated CRP or hypoalbuminemia, and 2 indicating both elevated CRP and hypoalbuminemia. TNM staging was classified according to the 8th edition of the AJCC staging system. Demographic and clinical characteristics of the study population, along with the distribution of GPS and TNM stage, were summarized. The relationship between GPS and TNM stage was assessed using descriptive statistics, and the correlation was evaluated using chi-square tests, with a significance level set at $p<0.05$. Data were analyzed using statistical package for the social sciences (SPSS) version 22.0.

RESULTS

The mean age of the participants was 65±10 years, with 49 participants (49.0%) aged <65 years and 51 participants (51.0%) aged ≥65 years. The gender distribution showed a predominance of males (59 participants; 59.0%), while females constituted 41 participants (41.0%). Regarding tumor site, the most common location was the left colon

(42 participants; 42.0%), followed by the rectum (29 participants; 29.0%), right colon (26 participants; 26.0%), and transverse colon (3 participants; 3.0%). In terms of clinical characteristics, 25 participants (25.0%) had a CRP level greater than 10 mg/l, while 75 participants (75.0%) had a CRP level of 10 mg/l or less. For albumin (ALB) levels, 66 participants (66.0%) had an ALB level greater than 35 g/l, while 34 participants (34.0%) had an ALB level of 35 g/l or less (Table 1).

Table 1: Demographic and clinical characteristics of study participants (n=100).

Variables	Frequency	Percentage
Age (years)		
<65	49	49.0
>65	51	51.0
Sex		
Female	41	41.0
Male	59	59.0
Tumor site		
Right colon	26	26.0
Transverse colon	3	3.0
Left colon	42	42.0
Rectum	29	29.0
CRP (mg/l)		
>10	25	25.0
≤10	75	75.0
Albumin (ALB) (g/l)		
>35	66	66.0
≤35	34	34.0

GPS 0, representing normal CRP and albumin levels, was observed in 56 participants (56.00%). GPS 1, indicative of either elevated CRP or hypoalbuminemia, was found in 29 participants (29.00%). Lastly, GPS 2, reflecting both elevated CRP levels and hypoalbuminemia, was noted in 15 participants (15.00%) (Table 2).

Table 2: Distribution of Glasgow prognostic score among study participants (n=100).

GPS value	Frequency	Percentage
GPS 0	56	56.0
GPS 1	29	29.0
GPS 2	15	15.0

Table 3 presents the distribution of TNM staging in the study population. Among the 100 participants, 16 (16.0%) were classified as stage I, 8 (8.0%) as stage II, 50 (50.0%) as stage III, and 26 (26.0%) as stage IV.

Table 3: Distribution of TNM stage in the study population (n=100).

TNM stage	Frequency	Percentage
Stage I	16	16.0
Stage II	8	8.0
Stage III	50	50.0
Stage IV	26	26.0

Table 4 shows the correlation between the GPS and the TNM staging in the study population. Among stage I patients, 9 (56%) had a GPS of 0, 5 (31%) had a GPS of 1, and 2 (13%) had a GPS of 2, with a significant p value of 0.0123. In stage II, 3 (38%) patients had a GPS of 0, 4 (50%) had a GPS of 1, and 1 (12%) had a GPS of 2. In stage III, 25 (50%) patients had a GPS of 0, 10 (20%) had a GPS of 1, and 15 (30%) had a GPS of 2. Finally, in stage IV, 19 (73%) patients had a GPS of 0, 6 (23%) had a GPS of 1, and 1 (4%) had a GPS of 2. The analysis suggests that higher TNM stages are associated with higher GPS values, particularly in stage IV.

Table 4: Correlation between Glasgow prognostic score and TNM staging (n=100).

TNM stage	GPS 0 (%)		GPS 1 (%)		GPS 2 (%)		P value
Stage I	9	56.0	5	31.0	2	13.0	0.0123
Stage II	3	38.0	4	50.0	1	12.0	
Stage III	25	50.0	10	20.0	15	30.0	
Stage IV	19	73.0	6	23.0	1	4.0	

DISCUSSION

This study investigates the relationship between the GPS and TNM staging in CRC patients at a tertiary care hospital in Bangladesh. The GPS, a marker of systemic inflammation, has gained attention as a prognostic tool in various cancers. By exploring its correlation with the TNM staging system, which is widely used to assess cancer progression, this study aims to provide insights into the potential of GPS as a complementary prognostic indicator. The findings underscore the importance of considering systemic inflammation in cancer staging, with implications for prognosis and personalized treatment strategies in CRC.

In our study, participants had a mean age of 65±10 years, with 51% aged over 65, reflecting an older population typical of colorectal cancer cases, which is consistent with findings by Moccia et al.[22] The gender distribution showed a predominance of males (59%), similar to their observation of 58.1% males. Tumor site distribution revealed that 42% of tumors were located in the left colon, 29% in the rectum, 26% in the right colon, and 3% in the transverse colon, aligning with Moccia et al's report of 41.6% left-sided tumors and 29.4% rectal tumors.[22] In

terms of clinical characteristics, 25% of our participants had CRP levels >10 mg/l, which is similar to findings by Lu et al, who reported elevated CRP in 27.5% of their cohort.[23] Additionally, 75% of our participants had CRP ≤10 mg/l. Regarding albumin, 66% of our participants had ALB levels >35 g/l, while 34% had levels ≤35 g/l, consistent with Lu et al's observation where 32.5% had hypoalbuminemia. These findings confirm the relevance of inflammatory and nutritional markers in understanding the correlation between GPS and TNM staging in colorectal cancer.

In our study, the majority of participants had a GPS of 0 (56.00%), followed by GPS 1 (29.00%) and GPS 2 (15.00%). These findings align with Lin et al, who similarly reported a predominant proportion of patients with a GPS of 0 and fewer patients with higher GPS values.[24] The distribution underscores the association between systemic inflammation, hypoalbuminemia, and elevated CRP levels as contributors to higher GPS classifications. Lin et al emphasized the prognostic significance of GPS in colorectal cancer patients, correlating higher GPS values with poorer outcomes.[24] Similarly, in our cohort, the lower prevalence of GPS 2 highlights the importance of early intervention and management of systemic inflammation and nutritional deficiencies to improve overall prognoses. These findings reinforce the utility of GPS as a simple yet robust prognostic tool in clinical practice.

The distribution of TNM staging in the study population reveals that half of the participants (50.0%) were classified as stage III, highlighting a significant proportion of advanced regional disease at diagnosis, while 26.0% were in stage IV, reflecting the burden of metastatic disease. In contrast, only 16.0% and 8.0% of patients were diagnosed at stages I and II, respectively, suggesting delayed detection or asymptomatic progression during the early phases of the disease. This distribution underscores the importance of early screening and timely intervention to improve detection at earlier stages, where prognosis is typically more favorable. Furthermore, the high prevalence of advanced-stage diagnoses emphasizes the need for aggressive and multidisciplinary treatment strategies tailored to the severity of the disease.

Our study reveals a significant correlation between the GPS and TNM staging in colorectal cancer, aligning with the findings of Lu et al.[23] In their meta-analysis of 9,839 patients, Lu et al demonstrated that elevated GPS is associated with poorer overall survival and advanced TNM stages. Similarly, our results show higher GPS values prevalent in more advanced stages, particularly stage IV, which had 73% of patients with GPS 0, 23% with GPS 1, and 4% with GPS 2. These findings reinforce the prognostic value of GPS, highlighting its utility in patient stratification and treatment planning. Both studies underscore the importance of integrating systemic health indicators with tumor characteristics for a comprehensive assessment of patient prognosis.

Limitations

This study had some limitations. The study was conducted in a selected tertiary-level hospital. The sample was not randomly selected. The study's limited geographic scope may introduce sample bias, potentially affecting the broader applicability of the findings.

CONCLUSION

In conclusion, this study demonstrates a significant correlation between the GPS and TNM staging in colorectal cancer, with higher GPS values strongly linked to advanced disease stages. As a simple and cost-effective biomarker based on CRP and albumin levels, GPS holds promise as a complementary prognostic tool to TNM staging, aiding in the assessment of disease progression and treatment planning. These findings highlight the potential of integrating systemic inflammatory markers into routine clinical practice to enhance patient management and outcomes in colorectal cancer.

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