

Prognostic Value of the Pretreatment Gustave Roussy Immune (GRIIm) Score in Metastatic or Recurrent Gastric Cancer Treated with First-Line Chemotherapy

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Abstract

Background

Metastatic and recurrent gastric cancer has heterogeneous clinical outcomes despite advances in systemic therapy. The Gustave Roussy Immune score (GRIm), derived from neutrophil-to-lymphocyte ratio, serum albumin, and lactate dehydrogenase, may provide additional prognostic information. This study evaluated the prognostic value of pretreatment GRIm score in patients with metastatic or recurrent gastric cancer receiving first-line chemotherapy.

Methods

We retrospectively reviewed patients diagnosed with gastric cancer and treated at the Department of Medical Oncology, SANKO University Faculty of Medicine, between January 2014 and December 2024. Eligible patients were aged 18–80 years, had metastatic disease at diagnosis or developed metastatic recurrence during follow-up, and received first-line chemotherapy. Patients were categorized into low-GRIm (0–1 points) and high-GRIm (2–3 points) groups. Overall survival (OS) and progression-free survival (PFS) were estimated using the Kaplan–Meier method, and prognostic factors for OS were evaluated using Cox regression analysis.

Results

A total of 145 patients were included. Seventy-nine patients (54.5%) were classified as low-GRIm and 66 (45.5%) as high-GRIm. Disease control was lower in the high-GRIm group than in the low-GRIm group (50.0% vs. 68.0%, $p = 0.037$). Median OS was significantly shorter in the high-GRIm group (8.0 vs. 12.0 months, $p = 0.001$), as was median PFS (3.0 vs. 6.0 months, $p = 0.015$). In multivariate analysis, high GRIm score remained independently associated with worse OS (HR 1.83, 95% CI 1.29–2.59, $p = 0.001$), along with peritoneal implant/metastasis, metastatic involvement of ≥ 2 sites, and poor differentiation.

Conclusions

Pretreatment GRIm may provide a simple means of prognostic risk stratification; further external validation is warranted before routine clinical implementation in metastatic or recurrent gastric cancer.

Introduction

Metastatic and recurrent gastric cancer remains a clinically challenging disease with limited long-term survival despite improvements in systemic treatment[1]. Although chemotherapy, targeted agents, and immune checkpoint inhibitors have expanded therapeutic options, outcomes vary substantially among patients with apparently similar disease characteristics[2, 3]. This heterogeneity indicates that

anatomical disease extent and conventional clinicopathological parameters may not fully capture the biological aggressiveness of the disease or the host-related factors that influence treatment response.

Cancer progression is closely linked to systemic inflammation, nutritional impairment, and altered tumor metabolism. These host–tumor interactions can be reflected by routine blood-based parameters, making them attractive tools for risk assessment in daily oncology practice[4, 5]. The Gustave Roussy Immune (GRIIm) score is a composite index derived from neutrophil-to-lymphocyte ratio (NLR), serum albumin, and lactate dehydrogenase (LDH), reflecting systemic inflammation, nutritional status, and tumor-related metabolic activity[6]. The score was initially introduced in the context of early-phase immunotherapy trials and has subsequently been investigated as a prognostic marker across multiple malignancies[6, 7]. In a meta-analysis including 15 studies and 4997 patients, a high GRIIm score was associated with inferior overall survival (OS) and progression-free survival (PFS) across different tumor types and treatment settings[7]. More recently, Deng et al. reported similar findings in a meta-analysis encompassing gastrointestinal cancers[8].

In advanced gastric cancer, previous studies have shown that a high pretreatment GRIIm score may be associated with chemotherapy resistance and shorter survival, while dynamic changes in GRIIm during nivolumab treatment have been associated with treatment response and survival[9, 10]. However, evidence remains limited in both patients with metastatic disease at diagnosis and those who develop metastatic recurrence after initially non-metastatic gastric cancer.

Therefore, this study aimed to evaluate the prognostic significance of pretreatment GRIIm score in patients with metastatic or recurrent gastric cancer. We also examined its association with clinicopathological features, metastatic patterns, treatment response, PFS, and OS.

Material and Methods

Patients

This retrospective study included patients diagnosed with gastric cancer and treated at the Department of Medical Oncology, SANKO University Faculty of Medicine, between January 2014 and December 2024. Medical records of 230 patients were screened for eligibility. Patients were eligible if they were 18–80 years of age, had histologically confirmed gastric cancer, had metastatic disease at diagnosis or developed metastatic disease during follow-up, and received first-line chemotherapy for metastatic or recurrent disease. All patients received first-line fluoropyrimidine- and platinum-based combination chemotherapy, with trastuzumab added in patients with HER2-positive disease when indicated. No patient received an immune checkpoint inhibitor or other targeted agent as part of first-line treatment.

After eligibility assessment, 51 patients were excluded because they did not have recurrent or metastatic disease. Among the remaining 179 patients, 34 were excluded because their medical records were not accessible or follow-up data were unavailable. Finally, 145 patients were included in the final analysis.

The exclusion criteria were inaccessible clinical records and absence of follow-up data. The patient selection process is summarized in Fig. 1.

We collected the following patient data: age, sex, histological subtype, tumor localization, tumor differentiation, Lauren classification, HER2 immunohistochemistry status, FISH results when available, lymphovascular invasion, perineural invasion, metastatic status at diagnosis, development of metastatic disease during follow-up, metastatic sites, first-line chemotherapy response, progression status, PFS, OS, and survival status at last follow-up. Patients without available response assessment data were excluded only from the treatment response analysis but were retained in the overall cohort and survival analyses if adequate follow-up and survival data were available. Pretreatment laboratory values used for GRIm calculation were obtained within two weeks before the initiation of first-line chemotherapy.

Ethical approval

was obtained from the SANKO University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee (Approval Code: 2025/12/1; Approval Date: 12 November 2025). Owing to the retrospective design of the study, the requirement for written informed consent was waived. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Definition of the GRIm Score

The GRIm score was determined for each patient using three pretreatment laboratory variables: serum LDH, serum albumin, and the NLR.

One point was assigned for each of the following abnormalities: LDH above the institutional upper limit of normal, albumin below 35 g/L, and NLR greater than 6. The total score therefore ranged from 0 to 3. Patients with scores of 0 or 1 were classified as the low-GRIm group, whereas those with scores of 2 or 3 were classified as the high-GRIm group. This score was used as a simple blood-based indicator reflecting the combined effects of systemic inflammation, nutritional status, and tumor-related metabolic activity.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics, version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean, median, range, and 95% confidence interval where appropriate, and categorical variables as frequencies and percentages. Patients were stratified into low- and high-GRIm groups according to pretreatment GRIm score. Group comparisons were performed using the chi-square test or Fisher's exact test for categorical variables and the Mann-Whitney U test for continuous variables.

HER2 positivity was defined as IHC 3 + or IHC 2 + with FISH positivity. Treatment response was assessed according to the Response Evaluation Criteria in Solid Tumors (RECIST), version 1.1[11]. Disease control

was defined as complete response, partial response, or stable disease after first-line chemotherapy; progressive disease was analyzed separately. OS was defined as the time from initiation of first-line chemotherapy to death from any cause, with patients who were alive censored at the date of last follow-up. PFS was defined as the time from initiation of first-line chemotherapy to the first documented disease progression or death from any cause, whichever occurred first; patients without progression or death were censored at the date of their last disease assessment. Survival outcomes were estimated using the Kaplan–Meier method and compared with the log-rank test.

Cox proportional hazards regression was used to evaluate factors associated with OS. Variables with clinical relevance or statistical significance in univariate analysis were entered into the multivariate model. Hazard ratios with 95% confidence intervals were reported, and two-sided p values < 0.05 were considered statistically significant.

Results

A total of 145 patients with metastatic or recurrent gastric cancer were included in the analysis. The mean age was 58 years, with a median age of 59 years (range: 23–80).

The mean OS was 13.9 months (95% CI, 10.85–16.96), with a median OS of 10 months (range, 1–96 months). The mean PFS was 5.6 months (95% CI, 5.0–6.3), with a median PFS of 5 months (range, 2–24 months). During follow-up, all 145 patients experienced disease progression. At the time of the final analysis, 140 patients (96.6%) had died, while 5 patients (3.4%) remained alive and were censored for OS at their last follow-up.

Ninety-six patients (66.2%) were male and 49 (33.8%) were female. The predominant histology was adenocarcinoma (n = 108, 74.5%), followed by signet-ring cell carcinoma (n = 36, 24.8%); histological subtype was not specified in one patient (0.7%). Tumors were located in the upper third in 30 patients (20.7%), middle third in 40 (27.5%), distal third in 42 (29.0%), and mixed sites in 33 (22.8%). Poor differentiation was observed in 83 patients (57.2%), and Lauren classification was intestinal type in 82 patients (56.6%) and diffuse type in 63 (43.4%). Metastatic disease was present at diagnosis in 81 patients (55.9%), whereas 64 patients (44.1%) subsequently developed metastatic disease. HER2 immunohistochemistry was negative in 107 patients (73.8%), + 1 in 18 (12.4%), + 2 in 8 (5.5%), and + 3 in 4 (2.8%); HER2 status was unknown in 8 patients (5.5%). Among HER2 IHC 2 + cases, FISH was positive in 2 patients. LVI data were available for 82 patients (56.6%), of whom 68 had LVI and 14 did not. PNI data were available for 79 patients (54.5%), of whom 58 had PNI and 21 did not. LVI and PNI status were unavailable in 63 (43.4%) and 66 (45.5%) patients, respectively. The most frequent metastatic sites were distant lymph nodes (n = 79, 54.5%), peritoneum (n = 68, 46.9%), and liver (n = 67, 46.2%), followed by lung (n = 29, 20.0%) and bone (n = 27, 18.6%).

GRIm score according to low- and high-risk groups

According to the pretreatment GRIIm score, 79 patients (54.5%) were classified into the low-risk group, whereas 66 patients (45.5%) were classified into the high-risk group. When the GRIIm score was evaluated as a 0–3 point score, 23 patients (15.9%) had a score of 0, 56 patients (38.6%) had a score of 1, 60 patients (41.4%) had a score of 2, and 6 patients (4.1%) had a score of 3.

The median age was not significantly different between the low- and high-risk groups (59 vs. 62 years, $p = 0.696$). Similarly, no significant differences were observed in sex distribution, histological subtype, tumor localization, differentiation status, Lauren classification, HER2 status, presence of liver metastasis, peritoneal implant/metastasis, lung metastasis, or distant lymph node metastasis between the two groups. However, bone metastasis was significantly more frequent in the high-risk GRIIm group than in the low-risk group (30.3% vs. 8.9%, $p = 0.001$) (Table 1).

Table 1
Patient characteristics according to GRIIm score

Clinicopathological variables	Low GRIIm n (%)	High GRIIm n (%)	p-value
Age, median, years	59	62	0.696
Sex			0.646
Male	51 (64.6)	45 (68.2)	
Female	28 (35.4)	21 (31.8)	
Histological subtype			0.555
Adenocarcinoma	60 (75.9)	48 (72.7)	
Signet-ring cell carcinoma	18 (22.8)	18 (27.3)	
Other/NOS	1 (1.3)	0 (0.0)	
Tumor localization			0.703
Upper third	19 (24.1)	11 (16.7)	
Middle third	22 (27.8)	18 (27.3)	
Distal third	21 (26.6)	21 (31.8)	
Mixed	17 (21.5)	16 (24.2)	
Differentiation			0.749
Well differentiated	4 (5.1)	5 (7.6)	
Moderately differentiated	28 (35.4)	25 (37.9)	
Poorly differentiated	47 (59.5)	36 (54.5)	
Lauren classification			0.913
Intestinal	45 (57.0)	37 (56.1)	
Diffuse	34 (43.0)	29 (43.9)	
Disease pattern			0.474
Metastatic at diagnosis	42 (53.2)	39 (59.1)	
Subsequently developed metastatic disease	37 (46.8)	27 (40.9)	
HER2 immunohistochemistry			0.322
* First-line treatment response was evaluable in 75 patients in the low-GRIIm group and 56 patients in the high-GRIIm group; percentages were calculated among evaluable patients.			

Clinicopathological variables	Low GRIm n (%)	High GRIm n (%)	p-value
Negative	55 (69.6)	52 (78.8)	
+ 1	10 (12.7)	8 (12.1)	
+ 2	4 (5.1)	4 (6.1)	
+ 3	3 (3.8)	1 (1.5)	
Unknown	7 (8.9)	1 (1.5)	
Lymphovascular invasion			0.195
Present	39 (49.4)	29 (43.9)	
Absent	10 (12.7)	4 (6.1)	
Unknown	30 (38.0)	33 (50.0)	
Perineural invasion			0.080
Present	30 (38.0)	28 (42.4)	
Absent	16 (20.3)	5 (7.6)	
Unknown	33 (41.8)	33 (50.0)	
Liver metastasis			0.402
Absent	45 (57.0)	33 (50.0)	
Present	34 (43.0)	33 (50.0)	
Peritoneal implant/metastasis			0.176
Absent	46 (58.2)	31 (47.0)	
Present	33 (41.8)	35 (53.0)	
Lung metastasis			0.934
Absent	63 (79.7)	53 (80.3)	
Present	16 (20.3)	13 (19.7)	
Bone metastasis			0.001
Absent	72 (91.1)	46 (69.7)	
Present	7 (8.9)	20 (30.3)	
* First-line treatment response was evaluable in 75 patients in the low-GRIm group and 56 patients in the high-GRIm group; percentages were calculated among evaluable patients.			

Clinicopathological variables	Low GRIIm n (%)	High GRIIm n (%)	p-value
Distant lymph node metastasis			0.727
Absent	37 (46.8)	29 (43.9)	
Present	42 (53.2)	37 (56.1)	
Number of metastatic sites			0.216
1 site	38 (48.1)	25 (37.9)	
≥ 2 sites	41 (51.9)	41 (62.1)	
First-line treatment response*			0.037
Disease control	51 (68.0)	28 (50.0)	
Progressive disease	24 (32.0)	28 (50.0)	
* First-line treatment response was evaluable in 75 patients in the low-GRIIm group and 56 patients in the high-GRIIm group; percentages were calculated among evaluable patients.			

The high-risk GRIIm group showed a significantly more unfavorable inflammatory and nutritional profile. Median lymphocyte count was significantly lower in the high-risk group (1.24 vs. 1.64, $p < 0.001$), whereas median neutrophil count (7.00 vs. 5.90, $p = 0.001$) and monocyte count (1.00 vs. 0.89, $p = 0.004$) were significantly higher. Hemoglobin was also significantly lower in the high-risk group (10.66 vs. 11.27 g/dL, $p = 0.036$). Platelet count did not differ significantly between the groups ($p = 0.951$). As expected from the GRIIm score components, median albumin was significantly lower in the high-risk group (31 vs. 37 g/L, $p < 0.001$), whereas median LDH (327 vs. 213 U/L, $p < 0.001$) and median NLR (6.10 vs. 3.29, $p < 0.001$) were significantly higher in the high-risk group.

First-line treatment response was evaluable in 131 patients; response assessment data were unavailable for 14 patients. These 14 patients were retained in the survival analyses because adequate follow-up and survival data were available. Disease control was achieved in 51 of 75 patients (68.0%) in the low-risk group and 28 of 56 patients (50.0%) in the high-risk group. Progressive disease was more frequent in the high-risk group (50.0% vs. 32.0%), and the disease control rate was significantly lower in patients with high GRIIm score ($p = 0.037$).

Kaplan–Meier curves for PFS and OS according to GRIIm group are shown in Fig. 2.

PFS was also significantly shorter in the high-GRIIm group. The median PFS was 6.0 months in the low-GRIIm group and 3.0 months in the high-GRIIm group. The estimated 3-, 6-, 9-, and 12-month PFS rates were 68.7%, 36.0%, 20.0%, and 16.0% in the low-GRIIm group, compared with 46.2%, 17.1%, 6.8%, and 4% in the high-GRIIm group. This difference was also significant (log-rank $\chi^2=5.894$, $p = 0.015$).

Patients in the high-GRIm group had significantly shorter OS than those in the low-GRIm group. The median OS was 12.0 months in the low-GRIm group and 8.0 months in the high-GRIm group. The estimated 6-, 12-, 18-, and 24-month OS rates were 77.2%, 48.8%, 23.9%, and 13.3% in the low-GRIm group, compared with 60.6%, 25.8%, 12.1%, and 5% in the high-GRIm group. The difference was statistically significant (log-rank $\chi^2=10.321$, $p = 0.001$).

In univariate Cox regression analysis, peritoneal implant/metastasis, poor differentiation, metastatic involvement of ≥ 2 sites, and high GRIm score were significantly associated with worse OS. In multivariate analysis, peritoneal implant/metastasis (HR 1.84, 95% CI 1.29–2.61, $p = 0.001$), metastatic involvement of ≥ 2 sites (HR 1.58, 95% CI 1.09–2.30, $p = 0.016$), poor differentiation (HR 1.56, 95% CI 1.09–2.22, $p = 0.015$), and high GRIm score (HR 1.83, 95% CI 1.29–2.59, $p = 0.001$) remained independent predictors of worse OS (Table 2).

Table 2

Univariate and multivariate Cox regression analyses of clinicopathological factors associated with overall survival

Clinicopathological variables	Univariate HR	95% CI	p value	Multivariate HR	95% CI	p value
Age*, ≥ 59 vs < 59 years	1.09	0.77–1.53	0.634			
Sex, female vs male	0.81	0.56–1.17	0.259			
Histology, signet-ring cell vs adenocarcinoma	1.05	0.71–1.54	0.808			
Pattern, de novo metastatic vs recurrent	1.06	0.75–1.49	0.744			
Liver metastasis, present vs absent	1.36	0.97–1.91	0.071			
Peritoneal implant/metastasis, present vs absent	1.96	1.39–2.75	< 0.001	1.84	1.29–2.61	0.001
Lung metastasis, present vs absent	1.22	0.81–1.84	0.340			
Bone metastasis, present vs absent	1.42	0.93–2.17	0.106			
Distant lymph node metastasis, present vs absent	1.13	0.80–1.59	0.477			
Lauren classification, diffuse vs intestinal	1.16	0.83–1.63	0.383			
Differentiation, poor vs well/moderate	1.44	1.02–2.04	0.037	1.56	1.09–2.22	0.015
HER2 status, positive vs negative/unknown	0.57	0.21–1.55	0.270			
Metastatic sites, ≥ 2 vs 1	1.90	1.33–2.72	< 0.001	1.58	1.09–2.30	0.016
GRIIm score, high vs low	1.68	1.20–2.36	0.002	1.83	1.29–2.59	0.001
* Age was dichotomized according to the median value of the cohort.						

Discussion

The present study provides additional real-world evidence supporting the prognostic value of pretreatment GRIIm score in patients receiving first-line chemotherapy for metastatic or recurrent gastric cancer. Patients with a high GRIIm score had a poorer inflammatory–nutritional profile, lower disease control rate, and significantly shorter OS and PFS than those with a low GRIIm score. Importantly, high GRIIm score remained independently associated with worse OS after adjustment for peritoneal metastasis, metastatic burden, and differentiation status.

Our results are consistent with the study by Nakazawa et al., in which pretreatment GRIIm was also associated with shorter OS and PFS in patients receiving first-line chemotherapy for advanced or recurrent gastric cancer[9]. Similarly, in our cohort, high GRIIm was associated with inferior OS, inferior PFS, and lower disease control after first-line chemotherapy. However, the proportion of high-GRIIm patients was higher in our study than in Nakazawa et al., which may reflect differences in patient selection, metastatic burden, timing of evaluation, and characteristics of our metastatic/recurrent cohort. In contrast to previous data[9], the distribution of de novo metastatic and recurrent disease was similar between the low- and high-GRIIm groups.

An interesting observation in our cohort was the higher frequency of bone metastasis in the high-GRIIm group, whereas other metastatic sites were not significantly different between GRIIm groups. This finding may reflect a subgroup with greater systemic inflammatory–metabolic burden, but it should be interpreted cautiously because of the limited number of patients with bone metastasis and the lack of independent prognostic significance for bone involvement in the Cox model.

Peritoneal implant/metastasis was also a strong adverse prognostic factor in our study, showing significance in both univariate and multivariate analyses. This result is in line with Nakazawa et al., who similarly identified peritoneal dissemination as an independent predictor of poor survival in unresectable advanced or recurrent gastric cancer treated with first-line chemotherapy[9]. Importantly, both peritoneal involvement and high GRIIm score retained independent prognostic significance in our model. These findings suggest that peritoneal involvement and GRIIm capture distinct prognostic aspects of disease burden and host status.

Other studies have also supported the prognostic relevance of GRIIm in gastric and gastroesophageal cancer. Ma et al. compared several prognostic scores in patients with metastatic gastric and esophageal cancer receiving first-line systemic therapy and found that the GRIIm score had the strongest ability to predict OS and early death[12]. In advanced gastric cancer treated with nivolumab, Nakazawa et al. showed that GRIIm after two courses of nivolumab, rather than pretreatment GRIIm alone, was associated with progressive disease and worse survival, suggesting that dynamic GRIIm changes may reflect immunotherapy sensitivity[10]. In non-metastatic settings, Shi et al. reported that high modified GRIIm was associated with shorter OS and DFS in resectable proximal gastric cancer[13], while Zhao et al. showed that GRIIm predicted DFS and OS in stage III gastric cancer[14]. More recently, Turhan et al. reported that high GRIIm was independently associated with worse OS and PFS in locally advanced gastric or gastroesophageal junction adenocarcinoma treated with neoadjuvant FLOT[15]. These studies

differ from ours because they mainly included curative-intent, locally advanced, or immunotherapy-treated populations, whereas our study focused specifically on metastatic or recurrent gastric cancer patients receiving first-line chemotherapy.

The prognostic value of GRIIm is also supported by data from other solid tumors, including non-small cell lung cancer, small cell lung cancer, hepatocellular carcinoma, and metastatic colorectal cancer[16–20]. In these studies, high GRIIm generally identified patients with inferior survival, although its ability to predict benefit from specific treatments has been less consistent. Therefore, the available evidence supports GRIIm primarily as a prognostic marker rather than a treatment-specific predictive biomarker. Our findings extend this concept to a real-world metastatic/recurrent gastric cancer population.

The association between GRIIm and survival is biologically plausible because each component of the score has previously been linked to adverse cancer outcomes. Elevated NLR reflects systemic inflammation and relative lymphocyte suppression, which may impair antitumor immune surveillance and promote treatment resistance. Low albumin reflects malnutrition and inflammation-mediated catabolism, both of which may reduce treatment tolerance and worsen prognosis. Elevated LDH may indicate higher tumor burden, hypoxia, and increased glycolytic activity, features commonly associated with aggressive tumor biology[7, 9]. Therefore, a high GRIIm score may identify patients with a combined phenotype of aggressive disease, impaired host reserve, and reduced sensitivity to systemic therapy.

From a clinical perspective, GRIIm score may help identify patients at increased risk of early progression and death before starting first-line chemotherapy. Because it is calculated from routinely available laboratory parameters, it can be easily incorporated into baseline assessment without additional cost or specialized testing. From a clinical perspective, GRIIm may provide a readily available tool for baseline prognostic risk stratification. Its potential role in guiding surveillance intensity, supportive interventions, or treatment planning should be evaluated prospectively.

This study has several limitations. First, its retrospective, single-center design may have introduced selection bias. Second, ECOG performance status was not available and therefore could not be incorporated into the multivariable analysis. Given the established prognostic importance of performance status in metastatic gastric cancer, this may have resulted in residual confounding and limits the interpretation of the independent prognostic value of GRIIm. Third, pretreatment inflammatory and biochemical parameters may have been influenced by transient clinical conditions or supportive interventions, including infection, biliary obstruction, corticosteroid or granulocyte colony-stimulating factor use, recent blood transfusion, and other comorbid conditions, which could not be systematically controlled for because of the retrospective design. Fourth, although all patients received fluoropyrimidine- and platinum-based chemotherapy with trastuzumab when indicated, individual chemotherapy regimens were not fully homogeneous. In addition, no patient received a first-line immune checkpoint inhibitor, which may limit the generalizability of our findings to contemporary immunotherapy-based treatment settings. Fifth, PFS assessment was based on retrospective clinical and radiological follow-up, which may have introduced variability in progression timing. Finally,

multivariable modeling was performed only for OS; therefore, the independent prognostic value of GRIm for PFS could not be established in this cohort.

In conclusion, pretreatment high GRIm score was associated with lower disease control, shorter OS and PFS, and independently worse OS in patients with metastatic or recurrent gastric cancer receiving first-line chemotherapy. GRIm score may provide additional prognostic information alongside conventional metastatic patterns and clinicopathological factors. External validation in larger prospective studies is needed before routine clinical implementation.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the SANKO University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee (Approval Code: 2025/12/1; Approval Date: 12 November 2025). The requirement for written informed consent was waived because of the retrospective design.

Consent for publication

Not applicable.

Availability of data and materials

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no conflicts of interest.

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Author contributions:

BBT: Conceptualization, methodology, data curation, formal analysis, writing – original draft, writing – review and editing, visualization, project administration.

MAM: Investigation, resources, writing – review and editing.

SC: Investigation, resources, writing – review and editing.

MY: Conceptualization, methodology, resources, supervision, writing – review and editing.

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Figures

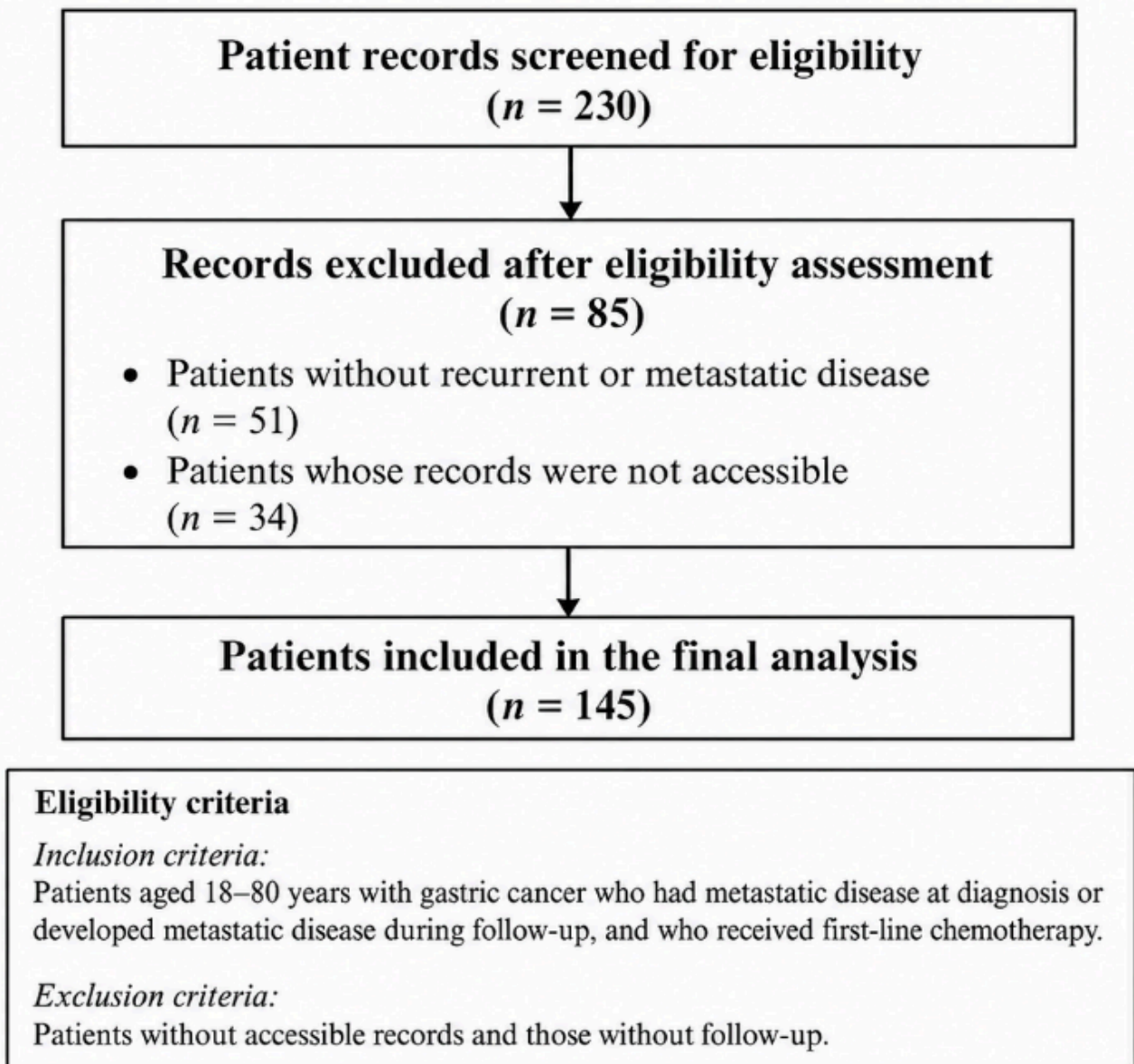


Figure 1

Flow diagram of patient selection and study inclusion.

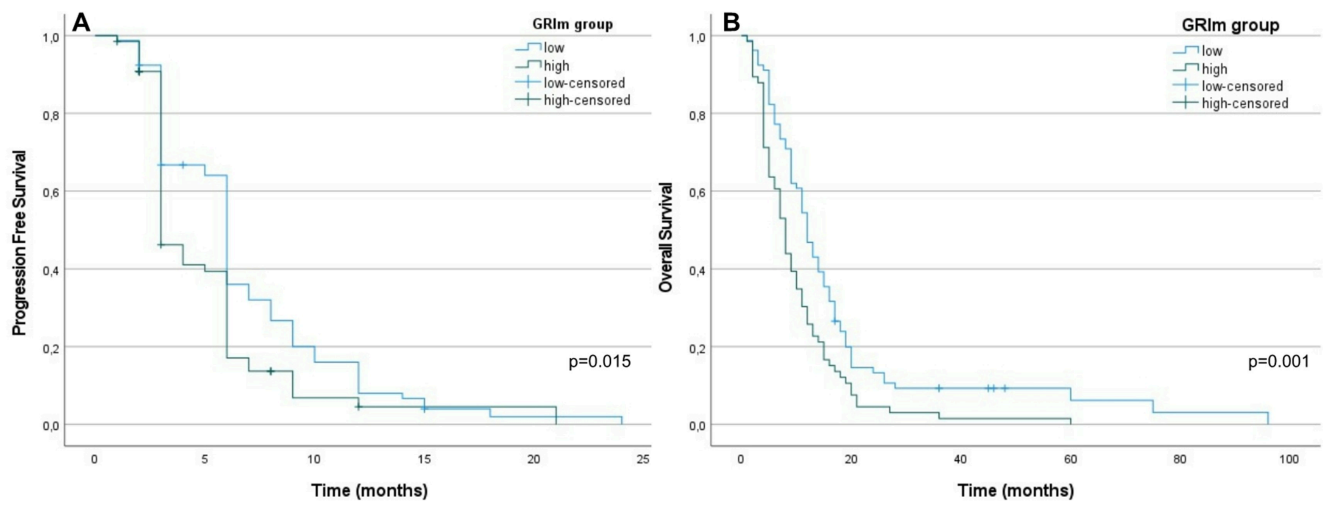


Figure 2

Kaplan–Meier curves for progression-free survival (A) and overall survival (B) according to GRIm group.