Original Article

Development and validation of an individualized nomogram for gastric cancer patients treated with perioperative chemotherapy followed by radical surgery

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Background: Prognostic factors are complicated and changeable for locally advanced gastric cancer (GC) patients. This study aimed to perform a novel prognostic model on survival for locally advanced GC patients who have received neoadjuvant chemotherapy and radical surgery.

Methods: The locally advanced GC patients with neoadjuvant chemotherapy were included in this study from Zhongshan Hospital, Fudan University. A nomogram was developed based on independent prognostic factors identified through a multivariable Cox regression model. Model performance was evaluated in training and independent external cohorts in terms of calibration, discrimination, and clinical usefulness.

Results: A total of 273 patients received radical resections. The median progression-free survival (PFS) and overall survival (OS) for all patients were 43.8 and 61.2 months, respectively. Nomogram showed that Lauren type made the greatest contribution to prognosis, followed by ypN. The prognostic nomogram had excellent discriminative ability, with a C-index of 0.689 [95% confidence interval (CI): 0.661–0.716], and an area under the receiver operating characteristic (ROC) curve (AUC) of 0.778, 0.746, and 0.725 for 3-, 5- and 10-year OS, respectively. Similar results were obtained in the external validation cohort. Based on the nomogram, the whole cohort was divided into high-risk and low-risk groups. And risk group classification was significantly associated with clinical characteristics, and produced an AUC value of 0.781, 0.748, and 0.727 for 3-, 5- and 10-year OS, respectively. Furthermore, compared with the tumor-node-metastasis (TNM) staging system (8th edition), Japanese criteria, and German criteria, the decision curve analysis (DCA) graphically demonstrated that the new model had more optimal net benefits in predicting the 3-, 5-, and 10-year OS for GC patients. Both C-index and time-dependent ROC curve demonstrated that the nomogram had a stronger capability for accurately predicting prognosis compared with the other staging system.

Conclusions: The nomogram model is an effective support tool to predict OS in GC patients undergoing perioperative chemotherapy followed by radical surgery.

Keywords: Locally advanced gastric cancer (locally advanced GC); neoadjuvant chemotherapy (NACT); radical surgery; prognostic model; risk group classification

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Introduction

Gastric cancer (GC) is the fifth most frequently diagnosed cancer and the third leading cause of cancer mortality worldwide (1). The highest GC incidence and mortality rates occur in East Asia, Latin America, and some Eastern European countries (2). Neoadjuvant chemotherapy (NACT) followed by radical operation has been recommended as the standard therapy for locally advanced GC as they could downstage the tumor, increase the rate of radical resection, and improve survival (3). The RESOLVE trial (4) showed that for locally advanced cT4a/N+M0 or cT4b/NxM0 GC, preoperative S-1 plus oxaliplatin (SOX) was superior to adjuvant capecitabine plus oxaliplatin (XELOX) [3-year disease-free survival (DFS) rate: 62.0% *vs.* 54.8%; P=0.045] (2). Meanwhile, the PRODIGY study (5) also reported that three cycles of neoadjuvant docetaxel plus oxaliplatin plus S-1 (DOS) chemotherapy followed by eight cycles of postoperative S-1 monotherapy improved 3-year DFS than surgery followed by eight cycles of S-1 monotherapy.

Extent of residual tumor in posttreatment gastrectomy specimens can be classified by widely accepted Becker's grading system proposed in 2003 (6) and The Japanese Gastric Cancer Association (JGCA) since 2011 (7). However, the above criteria mainly apply to primary tumor lesion without the description of lymph node changes. Post-neoadjuvant pathological Tumor Node Metastasis (ypTNM) staging system (8) has been considered as the best classification system for evaluating prognosis in clinical application. However, it could not reflect the changes of NACT. Prognostic factors are complicated and changeable for GC patients after receiving NACT and gastrectomy.

This study was designed to evaluate potential prognostic impact on tumor response and survival. Meanwhile, it also constructed a novel prognostic model on survival compared to Becker's, JGCA and ypTNM grading system. We present this article in accordance with the TRIPOD reporting checklist (available at https://tgh.amegroups.com/article/view/10.21037/tgh-23-75/rc).

Highlight box

Key findings

- A novel prognostic model was developed for locally advanced gastric cancer (GC) patients post-neoadjuvant chemotherapy and radical surgery.

What is known and what is new?

- Locally advanced GC prognosis is intricate and variable.
- The study introduces a novel nomogram-based prognostic model, advancing our understanding and prediction capabilities for overall survival in GC patients post-neoadjuvant chemotherapy and radical surgery.

What is the implication, and what should change now?

- These findings pave the way for a more nuanced and accurate prognostic evaluation, impacting the management and decision-making processes for locally advanced GC patients.

Methods

Patient selection

This study retrospectively reviewed consecutive locally advanced GC patients who received NACT and following radical surgery. Data were obtained from the Department of Medical Oncology of Zhongshan Hospital, Fudan University. Patients with histologically confirmed adenocarcinoma of the stomach or esophagogastric junction and higher clinical T2 category and/or positive lymph node were enrolled. The clinical TNM staging was assessed by endoscopic ultrasound examination, contrast computed tomography (CT) scan for chest, abdomen and pelvis, as well as physical examination. Patients with distant metastases, serious uncontrolled comorbid conditions and surgical contraindication were excluded. The protocol of this study was approved by the institutional ethical board of Zhongshan Hospital, Fudan University (No. B2020-185R). The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The informed consent was not required for this research because of the retrospective design.

Preoperative chemotherapy

All the patients received NACT and the regimen, dose and cycles were made after careful discussion between physicians and patients. Fluoropyrimidine-base chemotherapy regimens were divided into four categories: (I) taxane-based triplet (DOS, DOF, DOX, FLOT); (II) epirubicin-based triplet (ECF, ECX, EOF, EOX); (III) platinum-based doublet (FOLFOX, SOX, XELOX); and (IV) taxane-based doublet (DS, DF, DX).

Tumor response

After every two or three cycles, an abdominal and pelvic

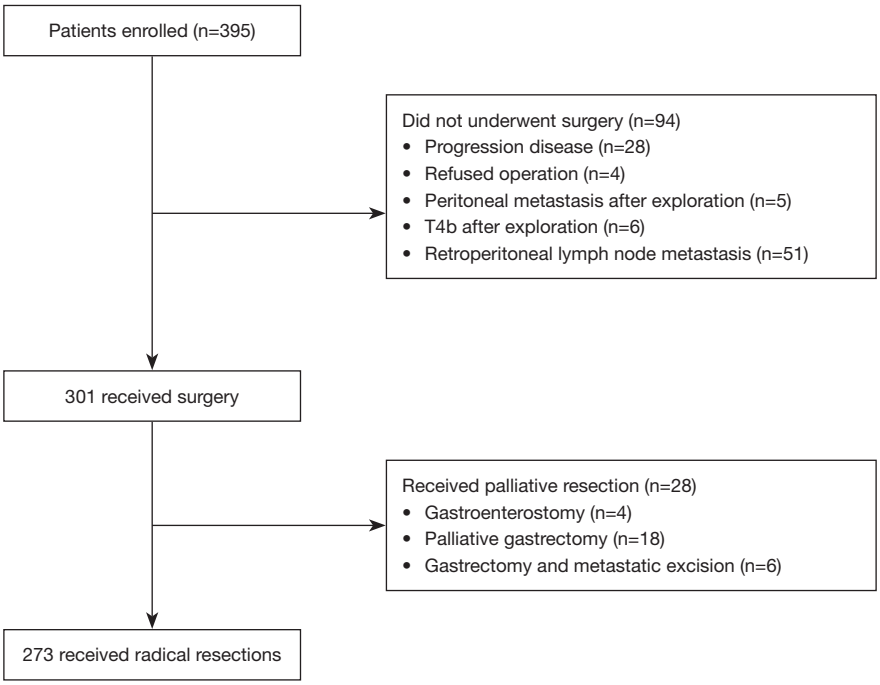

Figure 1 The flowchart of inclusion and exclusion for eligible gastric cancer patients in this study.

CT scan was performed to evaluate the tumor response. Resection was intended to be done within four to six weeks after four or six cycles of treatment. After resection, patients were resumed to the previous regimen with a total of eight cycles. Response to the treatment was evaluated according to Response Evaluation Criteria in Solid Tumors (RECIST) (9).

Surgical procedure and pathological evaluation

After the NACT, a total or subtotal distal gastrectomy with an extended lymph node resection (D2) was performed. The pathological response to chemotherapy was quantified. Changes in tumor size, tumor depth, lymph nodes metastases, as well as histological findings (necrosis, acellular mucinous lake, fibrosis, foamy-like histocyte reaction, vascular intimal hyperplasia, paraneural invasion, lymph-vascular invasion), and tumor residual ratio were assessed.

Statistical analysis

The categorical parameters were compared using Chi-squared test. The progression-free survival (PFS) and overall survival (OS) were generated by the Kaplan-Meier method and were compared by means of the log-rank test. R software (version 3.6.3) was used for statistical analyses. A $P<0.05$ was considered significant.

Results

Patients' characteristics

Among 395 patients with GC, 94 patients who did not undergo surgery were excluded for the following reasons: progression disease (n=28), refused operation (n=4), peritoneal metastasis after exploration (n=5), T4b after exploration (n=6), and retroperitoneal lymph node metastasis (n=51). Among the remaining 301 patients, 28 patients received palliative resection, including 4 underwent gastroenterostomy, 18 were treated with palliative gastrectomy, and 6 underwent gastrectomy with metastatic excision, were excluded. Thus, 273 patients treated with radical resections were enrolled in our study (*Figure 1*). Herein we summarized the clinico-pathologic information, treatment response and survival outcomes of all the patients using integrated bar plot and heatmap (*Figure 2*).

Treatment response

According to the RESUSIr/r patterns, more than half (159,

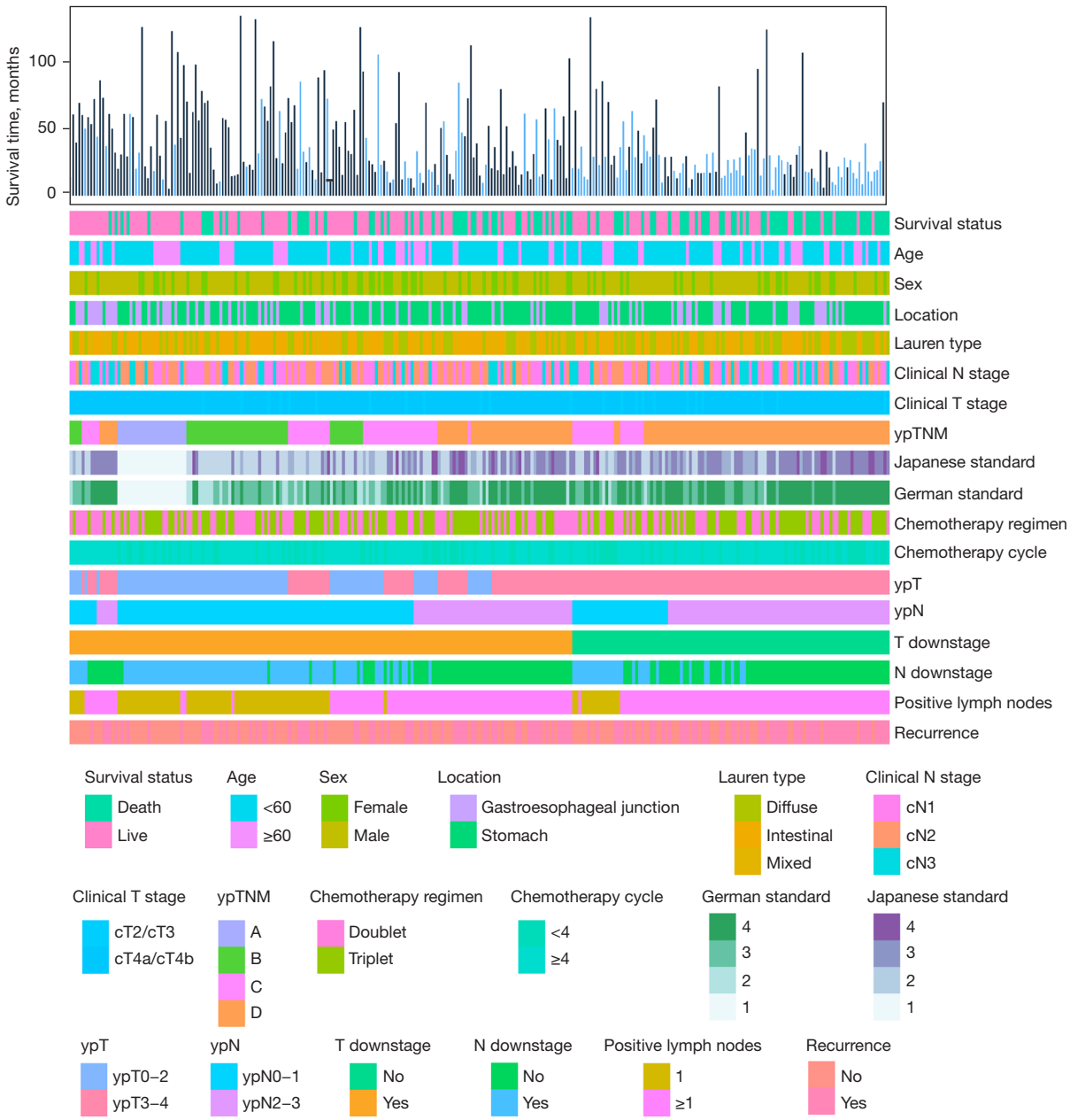

Figure 2 The integrated bar plot and heatmap of clinicopathologic information, treatment response and survival outcomes of GC patients in this study. The x-axis of bar plot represents individual GC patients. Sky blue bars represent patients who experienced mortality, while black bars signify patients who survived during the observed period. GC, gastric cancer.

58.0%) had reached stable disease (SD). One (4%) and 107 (39.1%) had complete response (CR) and partial response (PR), respectively, whereas two (7%) had progressive disease (PD). In addition, the response for five patients failed to evaluate since their tumor lesions were unmeasurable. The pathological response rate based on JGCA criteria, and Becker criteria was 43.1%, and 51.5%, respectively.

To evaluate the factors that were associated with the treatment response, we compared the baseline characteristics between non-responders (CR + PR) and responders (SD + PD) using Chi-squared tests. We observed that patients with intestinal type had a significantly increased rate of

Table 1 Chi-square tests for patients stratified by pathologic response status

Variable	Pathological response status		P
	Non-response (N=113)	Response (N=160)	
Gender, n			0.96
Male	83	119	
Female	30	41	
Age (years), n			0.44
≥60	61	78	
<60	52	82	
Location, n			0.17
Gastroesophageal junction	42	45	
Stomach	71	115	
Lauren type, n			0.03
Intestinal type	43	87	
Diffuse type	45	47	
Mixed type	25	26	
Clinical T stage, n			0.06
cT2	0	2	
cT3	5	15	
cT4a	98	137	
cT4b	10	6	
Clinical N stage, n			0.89
cN1	48	65	
cN2	41	57	
cN3	24	38	
Chemotherapy regimen, n			0.08
Taxane-based triplet	26	54	
Epirubicin-based triplet	20	28	
Platinum-based doublet	65	70	
Taxane-based doublet	2	8	

response in GC (*Table 1*), indicating intestinal type might tend to benefit from radical surgery after chemotherapy. Although no difference was observed in the overall response rate across different chemotherapy regimens, the overall response was higher in patients treated with platinum-based doublet regimen (*Table 1*). However, other characteristics (age, clinical T, and N stage) that we might consider advantageous had little influence on pathologic response were likely to respond better (*Table 1*). Furthermore, we performed logistic regression analysis to identify the factors that were associated with short-term response. The results confirmed that intestinal type was positively associated with better response (*Table 2*). Additionally, we found that the triplet regimen was more likely to improve the short-term response of GC patients although this difference was not significant [odds ratio (OR) = 0.610; 95% confidence interval (CI): 0.359–1.036; P=0.07].

Survival analysis

At the end of the follow-up, 112 patients died due to GC, and 161 patients survived. Kaplan-Meier survival analysis indicated that the median PFS and OS for all patients were 43.8 (95% CI: 35.0–67.6) and 61.2 (95% CI: 43.0–85.0) months, respectively. The 1-, 3-, and 5-year PFS rates were 81.7%, 54.6%, and 46.2%, respectively (*Figure 3A*); The 1-, 3-, and 5-year OS rates were 94.4%, 61.0%, and 50.4%, respectively (*Figure 3B*). After the radical surgery combined with chemotherapy, patients with intestinal tumors showed better PFS and OS than patients with diffuse type and mixed type (*Figure 3C,3D*). However, there were no differences in PFS and OS based on the chemotherapeutic regimen (Figure S1A,S1B), and cycles (Figure S1C,S1D). In addition, univariate Cox proportional hazard regression analysis showed that Lauren type, ypT, ypN, T downstage, N downstage and numbers of positive lymph nodes were significantly associated with both PFS and OS in all GC patients (*Table 3*). Furthermore, multivariable analysis of the above factors was performed to identify the independent prognostic factors for PFS and OS, respectively. The results indicated that Lauren type, ypT, and ypN were able to predict PFS (Figure S2). In terms of OS, intestinal type, and early ypN stage were independent prognostic factors for improvement of OS (*Figure 4*).

Prognostic risk factors and nomogram construction

Next, all independent prognostic factors of the Cox regression analysis were used to establish a nomogram to predict the 3-, 5-, and 10-year OS probability (*Figure 5A*). The two variables were scored by the Points scale ranging from 1 to 100. Nomogram uncovered that Lauren type made the greatest contribution to prognosis, followed by ypN. Each category of two parameters was assigned a score on the

Table 2 Multivariable logistic regression analysis of the factors associated with pathological response

Variable	Logistic regression		
	OR in pathological response	95% CI	P
Gender			
Male *vs.* female	0.950	0.518–1.742	0.87
Age (years)			
<60 *vs.* ≥60	0.986	0.960–1.013	0.31
Location			
Gastroesophageal junction *vs.* stomach	1.434	0.810–2.537	0.22
Lauren type			
Diffuse type *vs.* intestinal type	1.998	1.076–2.137	0.02
Mixed type *vs.* intestinal type	0.775	0.367–1.637	0.50
Clinical T stage			
cT2/cT3 *vs.* cT4a/cT4b	0.398	0.137–1.155	0.09
Clinical N stage			
cN1 *vs.* cN3	0.921	0.510–1.663	0.78
cN2 *vs.* cN3	0.873	0.435–1.750	0.70
Chemotherapy regimen			
Triplet regimen *vs.* doublet regimen	0.610	0.359–1.036	0.07

OR, odds ratio; CI, confidence interval.

Points scale. Total points were calculated by adding all the points from each parameter, which was located on the bottom scale. A line drawn straight down to the 3-, 5-, and 10-year Survival Probability scale suggested the estimated probability of OS of the individual patient at each time point.

Internal and external validations of nomogram, and risk group classification

To test the prediction ability of the nomogram model, internal and external validations were conducted, respectively. The time-dependent receiver operating characteristic (ROC) curve produced an area under the ROC curve (AUC) value of 0.778, 0.746, and 0.725 for 3-, 5- and 10-year OS (*Figure 5B*) in the training data set, respectively. Furthermore, we used the C-index and the calibration curves to evaluate the performance of the established nomograms. The C-index for nomogram prediction of OS were 0.689 (95% CI: 0.661–0.716), suggesting that the novel nomogram was considerably accurate. In addition, the calibration curves showed good agreement between the nomogram prediction and the survival outcome observed at 3-, 5-, and 10-year OS (*Figure 5C-5E*).

External validation was conducted in an independent cohort, which included a total of 145 gastric patients treated with NACT and radical surgery. Subsequently, it was applied to the nomogram, yielding a C-index of 0.728 (95% CI: 0.635–0.820), indicative of a commendable performance for our prediction model. The calibration curve demonstrated robust agreement between the actual and predicted risks of OS (*Figure 6A,6B*). The decision curve analysis (DCA) for the nomogram revealed that, over a substantial span of risk thresholds, employing the nomogram model for predicting OS contributed to a positive net benefit. Within this spectrum, the nomogram surpassed both the longest axis and shortest axis models, yielding the highest net benefit (*Figure 6C,6D*).

Utilizing the formulated nomogram, two distinct risk groups were identified based on the cumulative points: the low-risk group and the high-risk group (*Figure 7A*). We gauged the differences in clinicopathological characteristics between the high- and low-risk cohorts (*Figure 7A*).

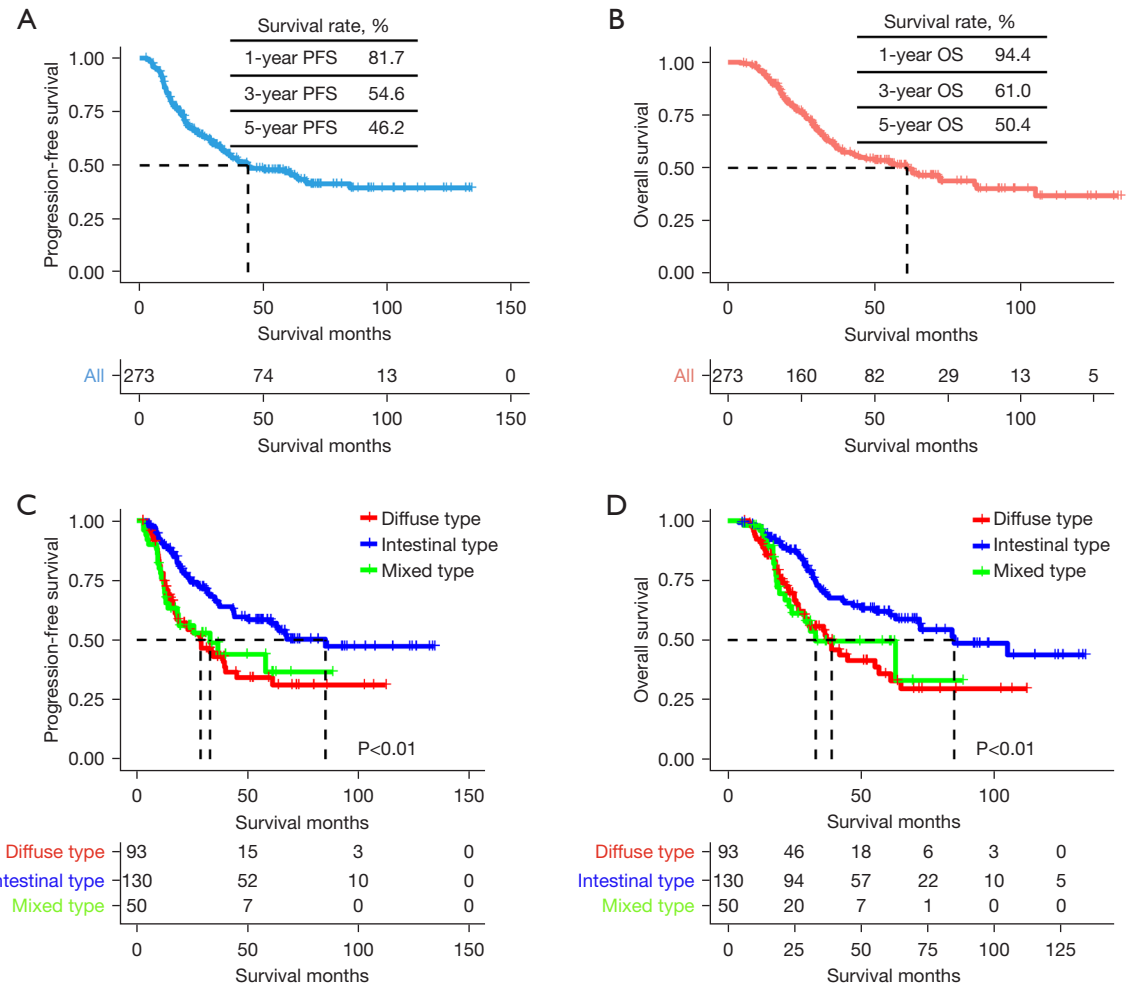

Figure 3 Kaplan-Meier survival analysis of PFS and OS of GC patients in this study. (A) PFS of the GC patients. (B) OS of the GC patients. (C) PFS of the GC patients stratified by the Lauren type. (D) OS of the GC patients stratified by the Lauren type. PFS, progression-free survival; OS, overall survival; GC, gastric cancer.

Compared with the low-risk group, proportion of patients with diffuse type tumor was higher in the high-risk group, yet the proportion of intestinal type tumors was higher in the low-risk group (*Figure 7A*). Kaplan-Meier analysis delineated a considerable disparity in survival time between patients classified in the high-risk and low-risk groups (*Figure 7B*). Additionally, the risk score exhibited an AUC value of 0.781, 0.748, and 0.727 for 3-, 5- and 10-year OS, respectively (*Figure 7C*).

Comparison of the novel nomogram and other staging systems

The efficacy and reliability of the novel model were assessed through a comparative analysis with the 8th edition TNM staging system, Japanese criteria, and German criteria. Compared with alternative staging system, the DCA vividly illustrated that the novel model yielded more optimal net benefits in forecasting the 3-, 5-, and 10-year OS of GC patients (*Figure 8A-8C*). Both C-index (*Figure 8D*) and time-dependent ROC curve (*Figure 8E*) demonstrated that the nomogram had a stronger capability for accurately predicting prognosis compared to the other staging system.

Discussion

The current investigation involving NACT followed by

Table 3 Univariate Cox proportional hazards regression analysis of factors associated with progress-free survival and overall survival in GC patients

Variable	Progress-free survival		Overall survival	
	Hazard ratio (95% CI)	P	Hazard ratio (95% CI)	P
Gender				
Female	Reference		Reference	
Male	0.759 (0.521–1.106)	0.151	0.781 (0.522–1.169)	0.23
Age (years)				
<60	Reference		Reference	
≥60	0.835 (0.557–1.251)	0.381	0.878 (0.569–1.354)	0.56
Location				
Gastroesophageal junction	Reference		Reference	
Stomach	0.896 (0.618–1.300)	0.564	0.809 (0.543–1.203)	0.30
Lauren type				
Diffuse type	Reference		Reference	
Intestinal type	0.504 (0.341–0.744)	0.001	0.500 (0.331–0.755)	0.001
Mixed type	0.967 (0.599–1.561)	0.890	0.972 (0.573–1.649)	0.92
Clinical T stage				
cT2/cT3	Reference		Reference	
cT4a/cT4b	0.712 (0.415–1.221)	0.217	0.679 (0.393–1.171)	0.16
Clinical N stage				
cN1	Reference		Reference	
cN2	0.947 (0.631–1.421)	0.793	1.087 (0.704–1.678)	0.71
cN3	1.437 (0.929–2.222)	0.103	1.535 (0.958–2.459)	0.08
Chemotherapy regimen				
Doublet regimen	Reference		Reference	
Triplet regimen	0.985 (0.695–1.396)	0.933	1.170 (0.802–1.705)	0.42
ypT				
ypT0-2	Reference		Reference	
ypT3-4	2.934 (1.915–4.496)	<0.001	3.199 (2.003–5.109)	<0.001
ypN				
ypN0-1	Reference		Reference	
ypN2-3	2.864 (1.984–4.133)	<0.001	3.194 (2.135–4.779)	<0.001
T downstage				
No	Reference		Reference	
Yes	0.538 (0.380–0.762)	<0.001	0.465 (0.320–0.674)	<0.001
N downstage				
No	Reference		Reference	
Yes	0.413 (0.284–0.600)	<0.001	0.401 (0.268–0.600)	<0.001
Positive lymph nodes				
0	Reference			
≥1	2.623 (1.703–4.041)	<0.001	2.689 (1.684–4.293)	<0.001

GC, gastric cancer; CI, confidence interval.

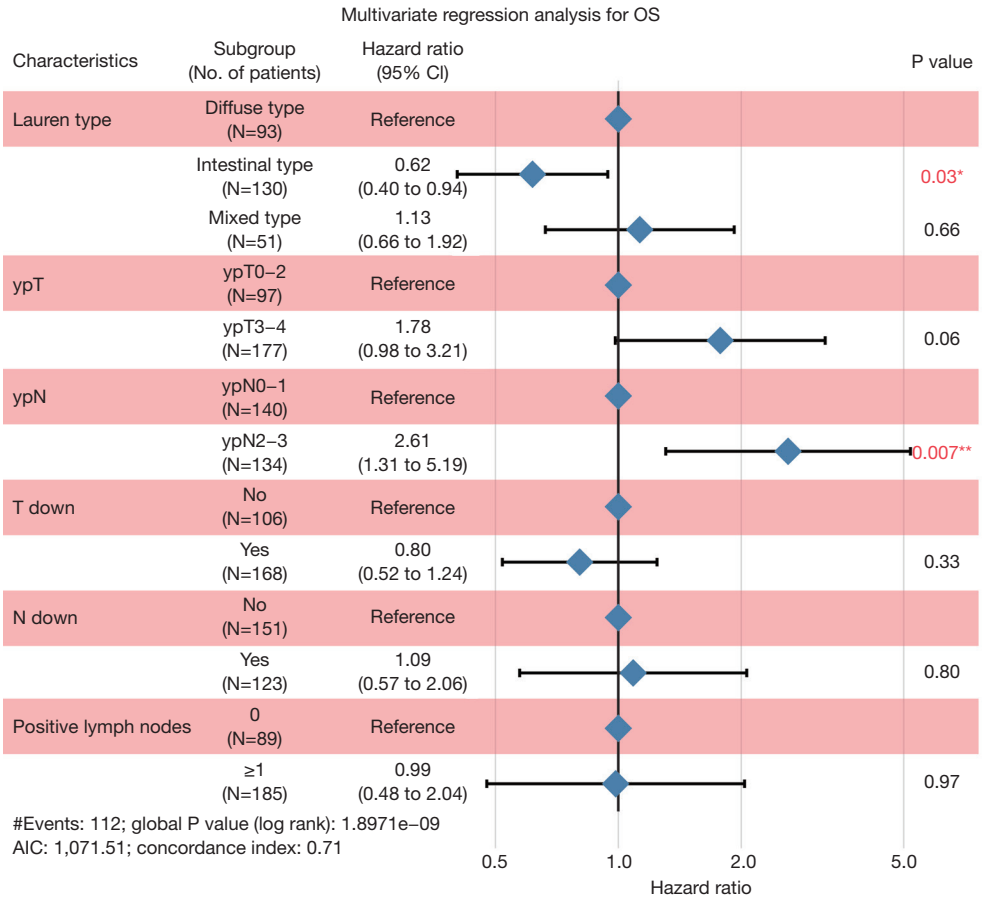

Figure 4 Forest plot for the multivariate Cox regression analyses of OS of the gastric cancer patients in this study. *, P<0.05; **, P<0.01. OS, overall survival; CI, confidence interval; AIC, Akaike information criterion.

radical surgery in Chinese patients with locally advanced GC has introduced a novel prognostic paradigm. This novel prognostic model outperformed the 8th edition TNM staging system (10), Japanese criteria (7), and German criteria (6) in predicting OS at 3-, 5-, and 10-year.

The results of this study indicated that Lauren type, ypT, and ypN were merely associated with statistical significance of PFS (Figure S2). It was unexpected that ypT was not included in the multivariate regression analysis of OS, and only intestinal type combined with early ypN stage were able to confirm the predictive value of improving OS (*Figure 5*). Furthermore, nomogram uncovered that Lauren type followed by ypN made the greatest contribution to prognosis. Utilizing the formulated nomogram, distinct low-risk and high-risk groups were delineated. The C-index for predicting OS using the nomogram stood at 0.689 (95% CI: 0.661–0.716), affirming the notable accuracy of the novel prognostic tool. The tumor regression grade (TRG) criteria are a system to assess the treatment response and the quantity of residual tumor. TRGs according to Becker and JGCA are commonly used to evaluate the effect of therapy and assess the prognosis. However, both of these systems mainly apply to primary tumor lesion, without the evaluation of lymph nodes. As chemotherapy acts on tumor tissue and induces a variety of changes in both the tumor and lymph node, that is why the TRG criteria accuracy could be weakened. The study has indicated that the Japanese criteria, and German criteria had less optimal net benefits in predicting the 3-, 5-, and 10-year OS of GC patients with NACT (*Figure 7*). Pathologically, the TNM staging system has attained widespread acceptance as the standard for assessing curative effects and prognosis. However, it falls short in accounting for the quantity of residual tumor and elucidating the alterations before and after NACT. Consequently, the ypTNM staging system, at times, compromises its precision as a prognostic predictor

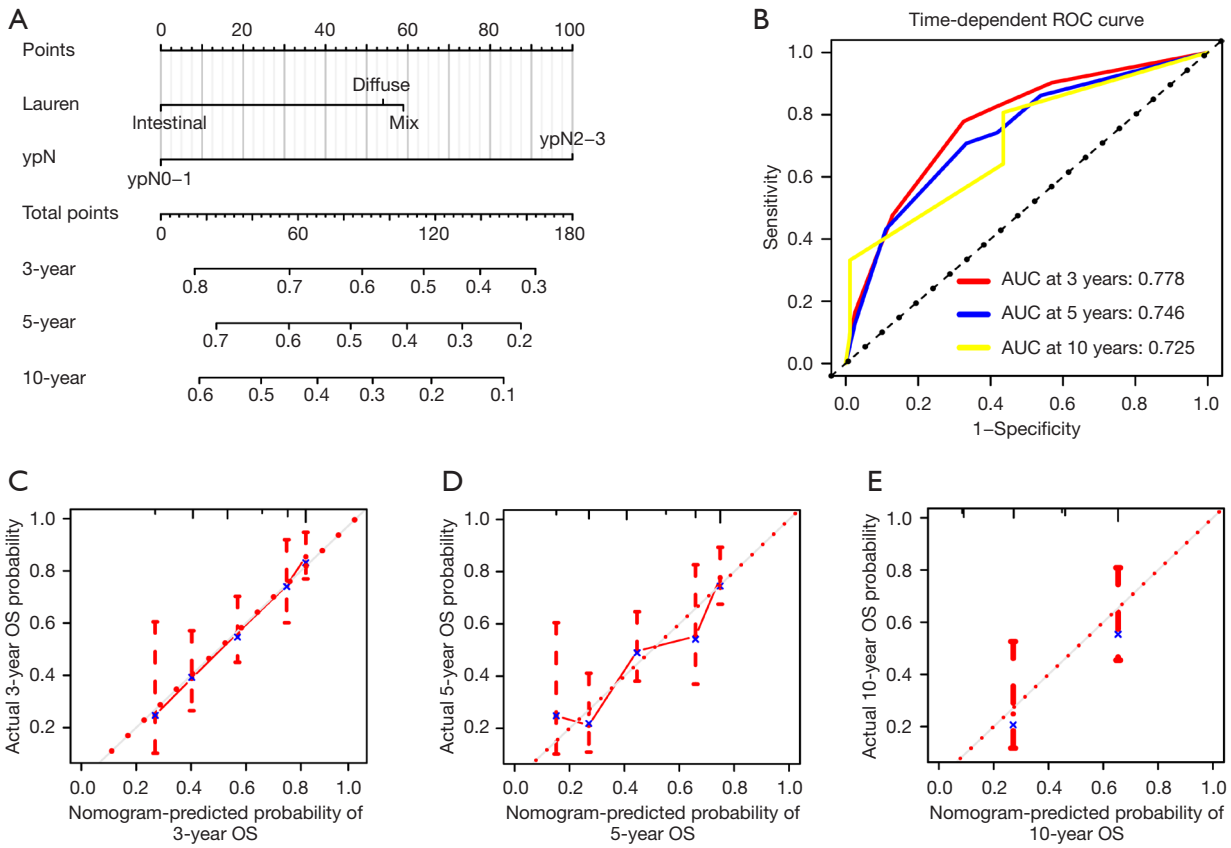

Figure 5 Construction and validation of the novel nomogram predicting 3-year, 5-year and 10-year OS for GC patients after radical resection. (A) Nomogram of the GC patients after radical resection. (B) Time-dependent ROC analysis for the performance of the nomogram at 3-, 5-, and 10-year OS. (C) 3-, (D) 5-, and (E) 10-year OS nomogram calibration curves. The dotted line represents the ideal match between the nomogram prediction (x-axis) and actual survival outcome (y-axis). Vertical bars indicate 95% confidence intervals. OS, overall survival; GC, gastric cancer; ROC, receiver operating characteristic; AUC, area under the curve.

in multivariable analysis (11). In our study, both the C-index and the time-dependent ROC curve unequivocally illustrated the heightened efficacy of the nomogram in precision prognostication compared to the ypTNM staging system.

Other prognostic patterns based on clinicopathological features such as tumor volume and graded histological regression have also been demonstrated as important prognostic factors in several studies (12-14). Tang *et al.* (13) demonstrated that post-therapy pathologic tumor volume predicted survival in GC patients who underwent NACT and radical gastrectomy. However, the method of calculation of tumor volume in these publications demanded the tumor diameter and tumor invasion depth. In comparison, our novel nomogram required only two parameters: Lauren type and ypN, which offered a more straightforward approach for clinicians to evaluate the prognosis of GC patients following NACT. Tong *et al.* (15) also compared the value of TRG according to Mandard and Becker criteria and there was no significant difference between these two systems.

In contemporary times, an increasing array of molecular biomarkers has been employed as prognostic factors in GC patients undergoing NACT (16-19). Li *et al.* (16) and Liu *et al.* (17) demonstrated that alterations of certain inflammatory markers before and after NACT held significance in predicting survival outcomes. Several studies (18,19) also found that several molecular attributes, including mutations in C10orf71 and IRS1, along with the tumor mutation burden, assumed a pivotal role in forecasting the response to NACT. These features emerge as promising candidates for prognostic

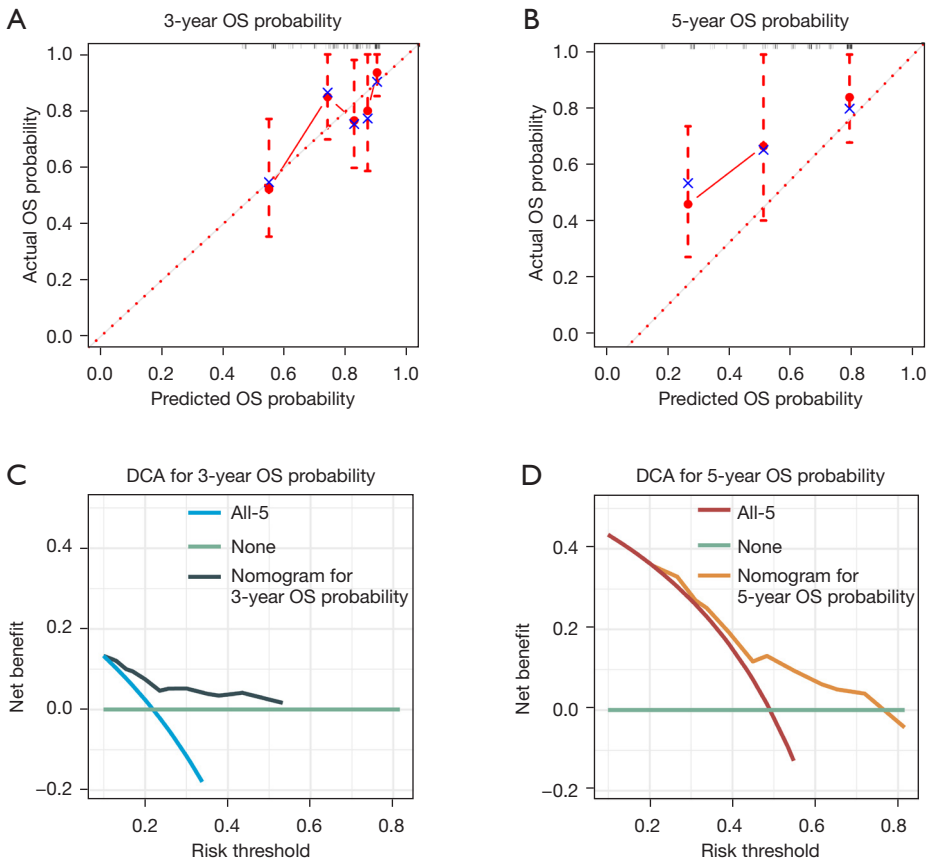

Figure 6 The external validation of nomogram using calibration curve, and DCA curve analysis, respectively. (A,B) The calibration curve analysis of the nomogram compared at (A) 3-, (B) 5-year OS. (C,D) DCA curve analysis of the nomogram compared at (C) 3-, (D) 5-year OS. The dotted line represents an ideal nomogram, and the solid red line represents the current nomogram. The vertical bars are 95% confidence intervals, and the × represents bootstrap-corrected estimate. DCA, decision curve analysis; OS, overall survival.

prediction. However, the identification and computation of these promising candidates incur substantial costs and complexities, rendering them inconvenient for routine clinical practice.

In this study, Lauren type at baseline had a significant association with the survival of GC patients receiving NACT after radical surgery. A clinical model was subsequently constructed base on Lauren type and lymph nodes to predict OS. Although the Lauren classification type was first raised in 1965 (20), it continues to exert a substantial impact on treatment decisions and prognostic assessments. Our previous study (21) had underscored the enduring significance of Lauren type as a consequential biomarker for GC patients following radical surgery and adjuvant chemotherapy.

Among individuals afflicted with intestinal-type GC, the efficacy of oxaliplatin-based adjuvant chemotherapy exhibited heightened effectiveness subsequent to D2 gastrectomy. However, this discernible survival benefit was not evident in those with the diffuse-type variant. Likewise, diffuse-type GC patients usually have a worse prognosis compared with intestinal-type patients in the advanced stage (22).

NACT for locally advance GC stands as a cornerstone in the clinical armamentarium, accorded Grade I endorsement in the guidelines of The Chinese Society of Clinical Oncology (CSCO) (3), owing to the impactful findings from RESOLVE trial (4) and PRODIGY study (5). However, evaluating prognosis of GC after NACT has precipitated a discernible schism. The results of our study indicated that the combination of Lauren type and residual lymph nodes after NACT and radical operation would impart a heightened precision in prognostic prediction. In this study, we are trying to provide a new tool for clinicians to

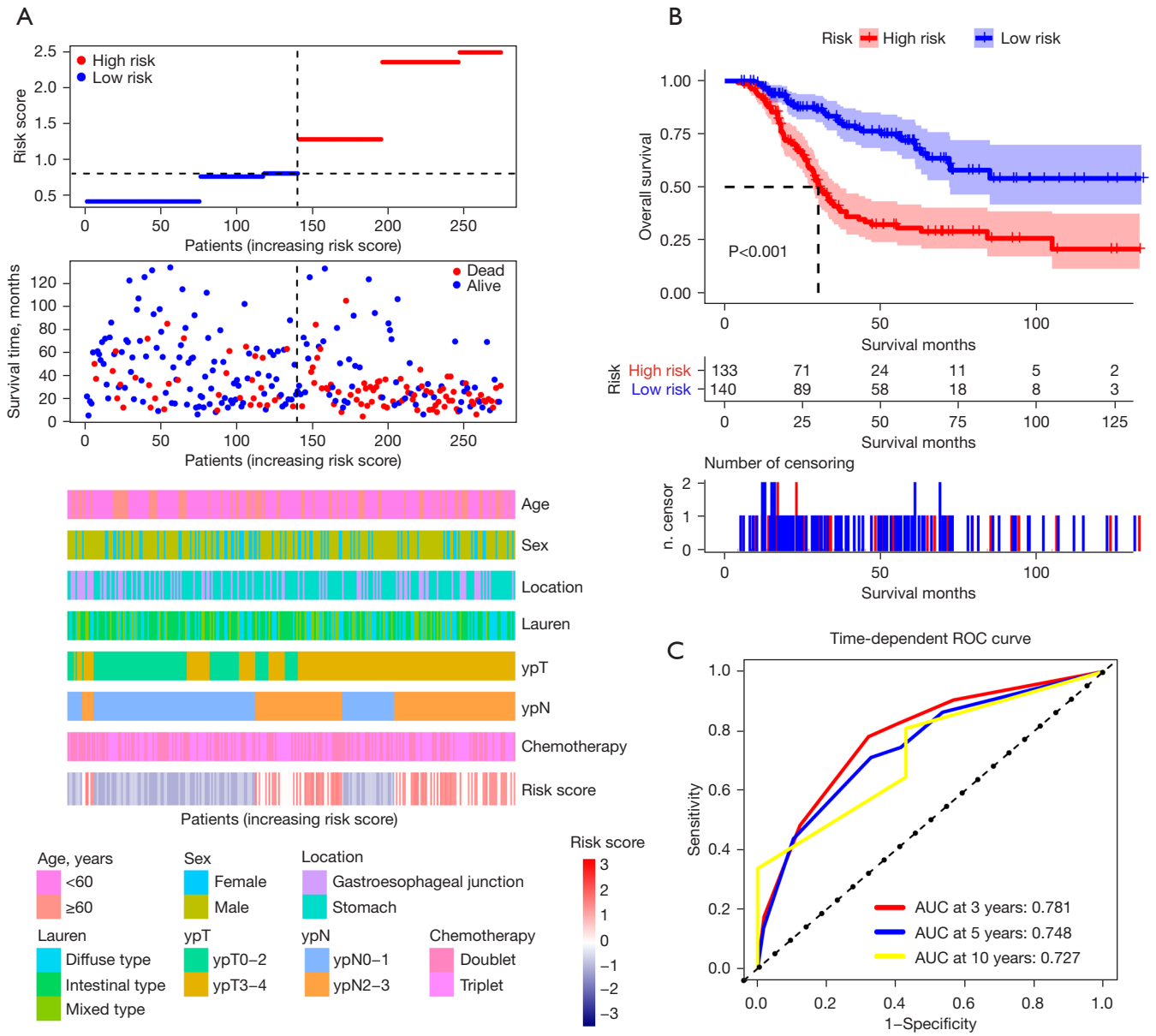

Figure 7 Nomogram-based risk score analysis. (A) Characteristics of the gastric cancer patients stratified by the median of nomogram-based risk score. (B) Kaplan-Meier curve of patients in low- and high-risk groups. (C) Time-dependent survival ROC curve for survival prediction at 3-, 5-, and 10-year OS by the nomogram-based risk score. ROC, receiver operating characteristic; AUC, area under the ROC curve; OS, overall survival.

evaluate the prognosis of GC patients who received NACT. The novel nomogram, effortlessly calculable through postoperative pathological reports, presented an avenue for prognostic evaluation sans additional encumbrance upon pathologists and surgeons.

Our study was constrained by its retrospective design, confinement to a single center, and the lack of standardized NACT regimens, potentially fostering selection bias. The relatively small sample size, albeit acknowledged, could potentially weaken the robustness of clinicopathological parameters, thereby contributing to a convergence in the survival analysis. Despite these inherent limitations, our investigation stood as a pioneering effort, introducing a nomogram model for the prognostication of survival in

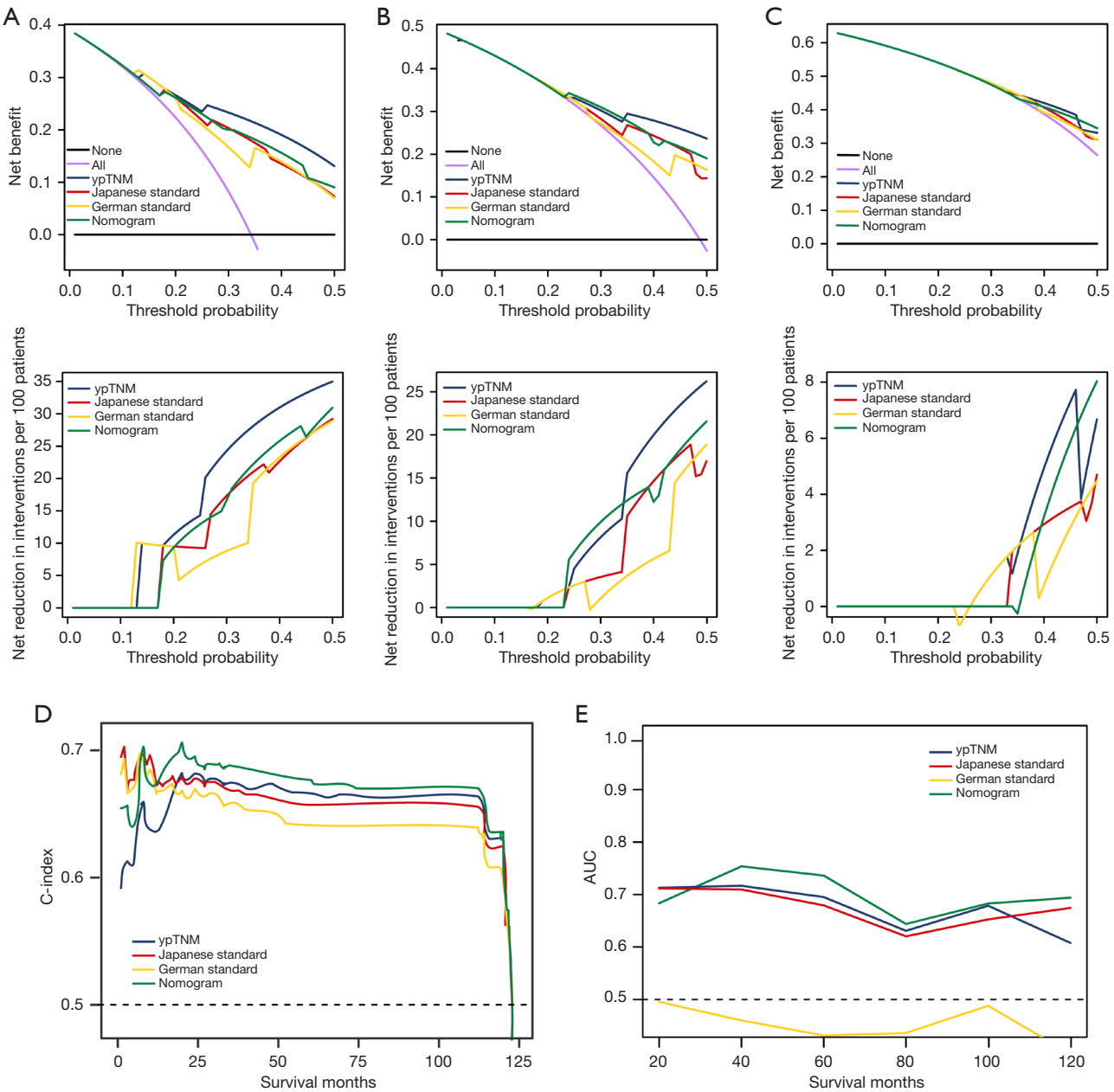

Figure 8 Comparison of the nomogram and other staging systems. DCA of the benefit for predicting OS at (A) 3-, (B) 5-, and (C) 10-year using the novel nomogram and other staging systems. The time-dependent (D) C-index and (E) ROC curves for gastric cancer patients were predicted by the nomogram and other staging systems. DCA, decision curve analysis; OS, overall survival; ROC, receiver operating characteristic; AUC, area under the ROC curve.

GC patients undergoing NACT. A distinctive feature of our study lay in its comparison of the nomogram with the TRG criteria and ypTNM staging system. To fortify the generalizability and credibility of our findings, future prospective endeavors should encompass expanded patient cohorts and extended follow-up durations.

Conclusions

Our study suggested that the nomogram model is a

potential independent prognostic paradigm on survival for the locally advanced GC patients treated with NACT and radical surgery. Meanwhile, our data reinforce the notion that incorporating Lauren type into the TNM staging might compensate for the limitations of TRG criteria.

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Footnote

Reporting Checklist: The authors have completed the TRIPOD reporting checklist. Available at https://tgh.amegroups.com/article/view/10.21037/tgh-23-75/rc

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://tgh.amegroups.com/article/view/10.21037/tgh-23-75/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The protocol of this study was approved by the institutional ethical board of Zhongshan Hospital, Fudan University (No. B2020-185R). The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The informed consent was not required for this research because of the retrospective design.

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