

World Journal of *Gastrointestinal Surgery*

World J Gastrointest Surg 2023 June 27; 15(6): 1007-1261



OPINION REVIEW

- 1007 Diverticulitis is a population health problem: Lessons and gaps in strategies to implement and improve contemporary care
Stovall SL, Kaplan JA, Law JK, Flum DR, Simianu VV

REVIEW

- 1020 Distal pancreatectomy with or without radical approach, vascular resections and splenectomy: Easier does not always mean easy
Bencini L, Minuzzo A

MINIREVIEWS

- 1033 Endoscopic ultrasound-guided portal pressure gradient measurement in managing portal hypertension
Lesmana CRA
- 1040 Robotic surgery in elderly patients with colorectal cancer: Review of the current literature
Teo NZ, Ngu JCY
- 1048 Median arcuate ligament syndrome often poses a diagnostic challenge: A literature review with a scope of our own experience
Giakoustidis A, Moschonas S, Christodoulidis G, Chourmouzi D, Diamantidou A, Masoura S, Louri E, Papadopoulos VN, Giakoustidis D
- 1056 Surgical complications of oncological treatments: A narrative review
Fico V, Altieri G, Di Grezia M, Bianchi V, Chiarello MM, Pepe G, Tropeano G, Brisinda G

ORIGINAL ARTICLE**Basic Study**

- 1068 Impact of interstitial cells of Cajal on slow wave and gallbladder contractility in a guinea pig model of acute cholecystitis
Ding F, Guo R, Chen F, Liu LP, Cui ZY, Wang YX, Zhao G, Hu H

Retrospective Cohort Study

- 1080 Fascia- vs vessel-oriented lateral lymph node dissection for rectal cancer: Short-term outcomes and prognosis in a single-center experience
Zhao W, Wang ZJ, Mei SW, Chen JN, Zhou SC, Zhao FQ, Xiao TX, Huang F, Liu Q
- 1093 Prognostic value of 11-factor modified frailty index in postoperative adverse outcomes of elderly gastric cancer patients in China
Xu ZY, Hao XY, Wu D, Song QY, Wang XX

Retrospective Study

- 1104** Long-term outcomes and failure patterns after laparoscopic intersphincteric resection in ultralow rectal cancers
Qiu WL, Wang XL, Liu JG, Hu G, Mei SW, Tang JQ
- 1116** Predictors for success of non-operative management of adhesive small bowel obstruction
Ng ZQ, Hsu V, Tee WWH, Tan JH, Wijesuriya R
- 1125** Preoperative albumin-bilirubin score is a prognostic factor for gastric cancer patients after curative gastrectomy
Szor DJ, Pereira MA, Ramos MFKP, Tustumi F, Dias AR, Zilberstein B, Ribeiro Jr U
- 1138** Ability of lactulose breath test results to accurately identify colorectal polyps through the measurement of small intestine bacterial overgrowth
Li L, Zhang XY, Yu JS, Zhou HM, Qin Y, Xie WR, Ding WJ, He XX
- 1149** Treatment outcome analysis of bevacizumab combined with cyclophosphamide and oxaliplatin in advanced pseudomyxoma peritonei
Zhang Y, Zhao X, Gao C, Lin LY, Li Y
- 1159** Surgical management of duodenal Crohn's disease
Yang LC, Wu GT, Wu Q, Peng LX, Zhang YW, Yao BJ, Liu GL, Yuan LW
- 1169** Influences of dexmedetomidine on stress responses and postoperative cognitive and coagulation functions in patients undergoing radical gastrectomy under general anesthesia
Ma XF, Lv SJ, Wei SQ, Mao BR, Zhao XX, Jiang XQ, Zeng F, Du XK
- 1178** Dissimilar survival and clinicopathological characteristics of mucinous adenocarcinoma located in pancreatic head and body/tail
Li Z, Zhang XJ, Sun CY, Li ZF, Fei H, Zhao DB

SYSTEMATIC REVIEWS

- 1191** Gallbladder perforation with fistulous communication
Quiroga-Garza A, Alvarez-Villalobos NA, Muñoz-Leija MA, Garcia-Campa M, Angeles-Mar HJ, Jacobo-Baca G, Elizondo-Omana RE, Guzman-Lopez S

META-ANALYSIS

- 1202** Efficacy of transanal drainage tube in preventing anastomotic leakage after surgery for rectal cancer: A meta-analysis
Fujino S, Yasui M, Ohue M, Miyoshi N

CASE REPORT

- 1211** Percutaneous transhepatic cholangial drainage-guided methylene blue for fistulotomy using dual-knife for bile duct intubation: A case report
Tang BX, Li XL, Wei N, Tao T

- 1216** Optimal resection of gastric bronchogenic cysts based on anatomical continuity with adherent gastric muscular layer: A case report
Terayama M, Kumagai K, Kawachi H, Makuuchi R, Hayami M, Ida S, Ohashi M, Sano T, Nunobe S
- 1224** Intrahepatic cholangiocarcinoma in patients with primary sclerosing cholangitis and ulcerative colitis: Two case reports
Miyazu T, Ishida N, Asai Y, Tamura S, Tani S, Yamade M, Iwaizumi M, Hamaya Y, Osawa S, Baba S, Sugimoto K
- 1232** Massive bleeding from a gastric artery pseudoaneurysm in hepatocellular carcinoma treated with atezolizumab plus bevacizumab: A case report
Pang FW, Chen B, Peng DT, He J, Zhao WC, Chen TT, Xie ZG, Deng HH
- 1240** Bedside ultrasound-guided water injection assists endoscopically treatment in esophageal perforation caused by foreign bodies: A case report
Wei HX, Lv SY, Xia B, Zhang K, Pan CK
- 1247** Modified stomach-partitioning gastrojejunostomy for initially unresectable advanced gastric cancer with outlet obstruction: A case report
Shao XX, Xu Q, Wang BZ, Tian YT
- 1256** Small bowel diverticulum with enterolith causing intestinal obstruction: A case report
Wang LW, Chen P, Liu J, Jiang ZW, Liu XX

ABOUT COVER

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The primary aim of *World Journal of Gastrointestinal Surgery* (*WJGS, World J Gastrointest Surg*) is to provide scholars and readers from various fields of gastrointestinal surgery with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJGS mainly publishes articles reporting research results and findings obtained in the field of gastrointestinal surgery and covering a wide range of topics including biliary tract surgical procedures, biliopancreatic diversion, colectomy, esophagectomy, esophagostomy, pancreas transplantation, and pancreatectomy, etc.

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Retrospective Cohort Study

Prognostic value of 11-factor modified frailty index in postoperative adverse outcomes of elderly gastric cancer patients in China

Zi-Yao Xu, Xin-Yu Hao, Di Wu, Qi-Ying Song, Xin-Xin Wang

Specialty type: Gastroenterology and hepatology**Provenance and peer review:** Unsolicited article; Externally peer reviewed.**Peer-review model:** Single blind**Peer-review report's scientific quality classification**Grade A (Excellent): 0
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Preoperative evaluation of frailty is limited to a few surgical procedures. However, the evaluation in Chinese elderly gastric cancer (GC) patients remains blank.

AIM

To validate and estimate the prognostic value of the 11-index modified frailty index (mFI-11) for predicting postoperative anastomotic fistula, intensive care unit (ICU) admission, and long-term survival in elderly patients (over 65 years of age) undergoing radical GC.

METHODS

This study was a retrospective cohort study which included patients who underwent elective gastrectomy with D2 Lymph node dissection between April 1, 2017 and April 1, 2019. The primary outcome was 1-year all-cause mortality. The secondary outcomes were admission to ICU, anastomotic fistula, and 6-mo mortality. Patients were divided into two groups according to the optimal grouping cutoff of 0.27 points from previous studies: High risk of frailty marked as mFI-11^{High} and low risk of frailty marked as mFI-11^{Low}. Survival curves between the two groups were compared, and univariate and multivariate regression analyses were performed to explore the relationship between preoperative frailty and postoperative complications in elderly patients undergoing radical GC. The discrimination ability of the mFI-11, prognostic nutritional index, and tumor-node-metastasis pathological stage to identify adverse postoperative outcomes was assessed by calculating the area under the receiver operating characteristic (ROC) curve.

RESULTS

A total of 1003 patients were included, of which 13.86% (139/1003) were defined as having mFI-11^{High} and 86.14% (864/1003) as having mFI-11^{Low}. By comparing the incidence of postoperative complications in the two groups of patients, it was found that mFI-11^{High} patients had higher rates of 1-year postoperative mortality, admission to ICU, anastomotic fistula, and 6-mo mortality than the mFI-11^{Low} group (18.0% *vs* 8.9%, $P = 0.001$; 31.7% *vs* 14.7%, $P < 0.001$; 7.9% *vs* 2.8%, $P < 0.001$; and 12.2% *vs* 3.6%, $P < 0.001$). Multivariate analysis revealed mFI-11 as an independent predictive indicator for postoperative outcome [1-year postoperative mortality: Adjusted odds ratio (aOR) = 4.432, 95% confidence interval (95%CI): 2.599-6.343, $P = 0.003$; admission to ICU: aOR = 2.058, 95%CI: 1.188-3.563, $P = 0.010$; anastomotic fistula: aOR = 2.852, 95%CI: 1.357-5.994, $P = 0.006$; 6-mo mortality: aOR = 2.438, 95%CI: 1.075-5.484, $P = 0.033$]. mFI-11 showed better prognostic efficacy in predicting 1-year postoperative mortality [area under the ROC curve (AUROC): 0.731], admission to ICU (AUROC: 0.776), anastomotic fistula (AUROC: 0.877), and 6-mo mortality (AUROC: 0.759).

CONCLUSION

Frailty as measured by mFI-11 could provide prognostic information for 1-year postoperative mortality, admission to ICU, anastomotic fistula, and 6-mo mortality in patients over 65 years old undergoing radical GC.

Key Words: Gastric cancer; Frailty; Mortality; Anastomotic fistula; Elderly

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Core Tip: Frailty is becoming an increasingly established risk factor for adverse postoperative outcomes. Given the innately high morbidity involved in radical gastric cancer and the propensity for comorbidities among this patient population, we sought to validate and estimate the prognostic value of the 11-index modified frailty index (mFI-11) in the postoperative period and long-term survival of those patients. The mFI-11 has proven to be a potential exponential tool that can easily stratify patients, predict long-term outcomes, and add value to future treatments.

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INTRODUCTION

Globally, gastric cancer (GC) is one of the most common cancers, accounting for more than 1 million cases a year, or 7 percent of all cancer diagnoses[1]. With the development of social aging, there is an increasing trend of patients with GC over the age of 65, and most of them are in the middle or late stages of diagnosis because of the hidden nature of GC[2]. As a general rule, gastrectomy + D2 lymph node dissection is the primary surgical procedure for advanced GC, which has been accepted in many countries[3]. Current perioperative management strategies are maturing; however, serious complications may still occur after radical resection of GC, affecting quality of life, tolerability, and outcome of subsequent management[4]. Thus, preoperative risk assessment and post-cancer symptom management in older patients remains critical.

Numerous studies have shown the predictive role of some indicators regarding postoperative complications, including tumor-node-metastasis (TNM) pathological stage and prognostic nutritional index (PNI)[5-7]. However, these indicators lack the ability to measure the physiological reserve of patients, so this paper introduces the concept of frailty in order to provide references for comprehensive preoperative assessment and risk stratification. Frailty is a complex clinical syndrome characterized by reduced physical strength, reduced metabolic and cognitive function, reduced resistance to adverse events, and reduced ability to deal with surgical blows[8]. Moreover, frailty has been investigated as a valuable predictor of adverse health events and poor postoperative outcomes in patients undergoing surgery. Frailty index (FI) is one of the tools for quantifying the degree of frailty in the clinic, and Velanovich and his colleagues summarized the frailty index with 11 variables, known as the 11-index modified frailty index (mFI-11)[9]. Previous studies have confirmed that frailty is an independent risk factor for perioperative complications in elderly patients. The more frailty the patient, the higher the

incidence of postoperative adverse outcomes[10].

At this stage, preoperative evaluation of weakness is limited to a few surgical procedures such as arthroplasty, colorectal cancer, and urological tumors[11,12]. However, the evaluation of preoperative frailty in Chinese elderly GC patients remains blank. The purpose of this study was to evaluate the efficacy of mFI-11 applications in predicting adverse outcomes after radical GC surgery in elderly patients in China, and compare the efficacy of mFI-11, TNM stage, and PNI in predicting adverse outcomes after surgery.

MATERIALS AND METHODS

Patients

Medical records and clinicopathologic data of patients aged 65 years and older who underwent radical GC surgery were retrospectively studied at the Department of Gastrointestinal Surgery of the First Medical Center of the People's Liberation Army General Hospital (Beijing) between April 1, 2017 and April 1, 2019. Research design and data analysis were approved by the Committee of Medical Research Ethics (Approval No. S2021-342-01). The same committee waived the requirement of written informed consent for participation. The inclusion criteria were: (1) Patients over the age of 65 admitted to the study unit; (2) All patients had histologic confirmation of GC and underwent radical gastrectomy with D2 lymph node dissection; and (3) Patients and their families agreed to provide long-term follow-up information. The exclusion criteria were: (1) Patients had other systemic tumor diseases; (2) Patients who had missing covariate data or follow-up; (3) Patients underwent palliative surgery for distant metastasis and extraregional lymph node metastasis; and (4) Patients received perioperative neoadjuvant chemotherapy. Figure 1 shows the flow chart of this study. The main characteristics of 1003 people included in this study are summarized in Table 1.

Data collection and outcomes

Data were obtained from electronic medical record systems using SQL server (Microsoft, United States). Demographic data were extracted from the Integrated Patient Records Management System (PRIDE 2.1.2.193, Heren Health, China), including age, sex, body mass index, hypertension, diabetes, cardiovascular and lung diseases, cerebrovascular diseases, delirium, independent functional status, and American Society of Anesthesiologists physical score (ASA PS). A non-independent functional state was defined when a patient was unable to perform basic life care alone prior to surgery, such as washing clothes, eating, simply exercising physically, or requiring a full-time escort from a family member, as noted in the care record. Laboratory indicators include serum albumin and lymphocytes. From the anesthesia information management systems (DoCare 3.1.0 build 153, MEDICALSYSTEM, China), intraoperative data were retrieved, including surgical procedures, duration of surgery, ASA PS, TNM stage, and pathologic types of GC. Primary outcome was 1-year of all-cause mortality. Secondary outcomes were 6-mo mortality, anastomotic fistula, and admission to intensive care unit (ICU).

Measurements

We selected mFI-11, TNM stage, and PNI to predict adverse outcomes after radical GC resection in elderly patients, and compared the prognostic value of all three. Initially, because the FI scale contained more than 70 variables, which led to poor clinical outreach, we developed mFI-11 that mapped 70 variables from the original FI to 11 preexisting variables in the National Surgery Quality Improvement Program (NSQIP) database[13]. The 11 variables that were used to calculate the mFI-11 were functional status, history of diabetes, respiratory problems, congestive heart failure, myocardial infarction, cardiac problems, arterial hypertension, delirium, history related to cognitive impairment or loss, cerebrovascular problems, and history of stroke/decreased peripheral pulses[14]. Details of specific variables that match these factors are defined in Supplementary Table 1. mFI-11 score was calculated by dividing the number of positive variables in the patient by the number of total variables (11). Scores range from 0 to 1. High-risk frailty (mFI-11^{High}) was defined when the mFI-11 score was ≥ 0.27 and low-risk frailty (mFI-11^{Low}) was defined when the score was less than 0.27. PNI was calculated as $10 \times$ peripheral serum protein (g/L) + $0.005 \times$ peripheral blood lymphocyte count (mm^3)[15]. PNI is a commonly used indicator to evaluate the nutritional and immune status of patients, which can predict the surgical risk and postoperative complications.

Statistical analysis

If the continuous data are normally distributed, they are shown as the mean \pm SD, otherwise they are shown as median and interquartile range (IQR). The categorical data are presented as proportions. Categorical data are reported as frequencies and percentages and compared using the χ^2 test or Fisher's exact test as appropriate. Univariate and multivariate logistic regression analyses were performed to determine independent risk factors for postoperative mortality, anastomotic fistula, and admission to ICU. Receiver operating characteristic (ROC) curve analysis was used to evaluate the efficacy of

Table 1 Intergroup comparison of demographics, intraoperative information, and mFI-11-related variables in 1003 patients

Variable	mFI ^{Low} (n = 864)	mFI ^{High} (n = 139)	P value
Age (yr)			0.0392
65-75	686 (79.4)	102 (73.4)	
≥ 75	178 (20.6)	37 (26.6)	
Gender, male, n (%)	656 (75.9)	109 (78.4)	0.522 ²
BMI (kg/m ²)	23.47 ± 3.49	24.65 ± 2.97	0.081 ¹
Smokers, n (%)	300 (34.7)	54 (38.8)	0.345 ²
Drinkers, n (%)	51 (5.9)	18 (12.9)	0.002 ²
Serum albumin (g/L)	36.05 ± 4.29	27.85 ± 4.56	< 0.001 ¹
Lymphocytes (× 10 ⁹ /L)	0.20 ± 0.11	0.19 ± 0.11	0.527 ¹
PNI	37.03 ± 4.31	28.83 ± 4.58	< 0.001 ¹
TNM stage, n (%)			< 0.001 ²
I	159 (18.4)	12 (8.6)	
II	405 (46.9)	30 (21.6)	
III	237 (27.4)	61 (43.9)	
IV	63 (7.3)	36 (25.9)	
ASA physical stage, n (%)			< 0.001 ²
I + II	706 (81.71)	78 (56.12)	
III + IV	158 (18.29)	61 (43.88)	
Gastrectomy, n (%)			0.361 ²
DG	379 (43.9)	52 (37.4)	
PG	117 (13.5)	21 (15.1)	
TG	368 (42.6)	66 (47.5)	
Surgical approach, n (%)			0.035 ²
Open	85 (9.8)	15 (10.8)	
Robotic surgery	92 (10.6)	25 (18.0)	
Laparoscopy	687 (79.5)	99 (71.2)	
Surgery duration (min)	202.40 ± 63.07	214.02 ± 62.00	0.041 ¹
Diabetes mellitus	111 (12.8)	78 (56.1)	< 0.001 ²
Myocardial infarction	10 (1.2)	18 (12.9)	< 0.001 ²
Cardiac problems	52 (6.0)	27 (19.4)	< 0.001 ²
Congestive heart failure	1 (0.1)	3 (2.2)	< 0.001 ²
Cerebrovascular problems	101 (11.7)	44 (31.7)	< 0.001 ²
Stroke	1 (0.1)	6 (4.3)	< 0.001 ²
Decreased peripheral pulses	21 (2.4)	29 (20.9)	< 0.001 ²
Respiratory problems	12 (1.4)	20 (14.4)	< 0.001 ²
Non-independent functional status	38 (4.4)	27 (19.4)	< 0.001 ²
Clouding or delirium	43 (5.0)	32 (23.0)	< 0.001 ²
Arterial hypertension	235 (27.2)	119 (85.6)	< 0.001 ²
Outcomes			
1-year mortality	77 (8.9)	25 (18.0)	0.001 ²
Admission to ICU	127 (14.7)	44 (31.7)	< 0.001 ²

Anastomotic fistula	24 (2.8)	11 (7.9)	< 0.001²
6-mo mortality	31 (3.6)	17 (12.2)	< 0.001²

¹t test;

²Pearson χ^2 .

P less than 0.05 is marked as bold. BMI: Body mass index; ASA: American Society of Anesthesiologists; TNM: Tumor-node-metastases; DG: Distal partial gastrectomy; TG: Total gastrectomy; PG: Proximal partial gastrectomy; PNI: Prognostic nutritional index; mFI-11: 11-Item modified frailty index; ICU: Intensive care unit.

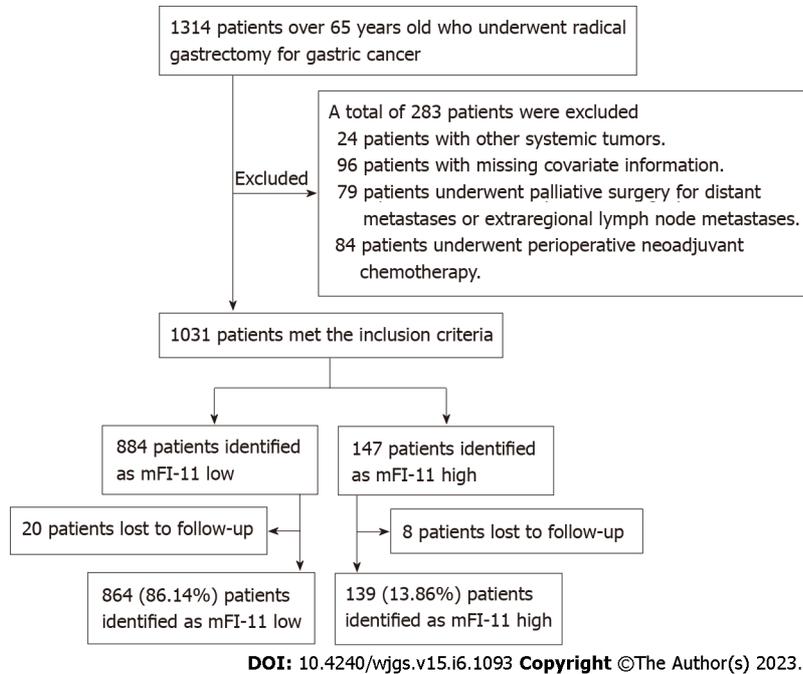


Figure 1 Flowchart. mFI-11: 11-index modified frailty index.

different variables in predicting postoperative mortality, anastomotic fistula, and admission to ICU. The mFI-11^{High} group and mFI-11^{Low} group were compared using Kaplan-Meier (K-M) survival curves. A *P* value inferior to 0.05 was set to reach significance. Data analyses were performed using the SPSS software (version 26.0, IBM, Armonk, NY, United States).

RESULTS

Complications

A total of 1003 patients were included, of which 13.86% (139/1003) were defined as having mFI-11^{High} and 86.14% (864/1003) as having mFI-11^{Low}. **Figure 2** compares the incidence of postoperative ICU admission, anastomotic fistula, death at 6 mo, and death at 1 year in both groups. By comparing the incidence of postoperative complications in the two groups of patients, it was found that mFI-11^{High} patients had higher rates of 1-year postoperative mortality, admission to ICU, anastomotic fistula, and 6-mo mortality than the mFI-11^{Low} group (18.0% vs 8.9%, *P* = 0.001; 31.7% vs 14.7%, *P* < 0.001; 7.9% vs 2.8%, *P* < 0.001; 12.2% vs 3.6%, *P* < 0.001).

ROC and K-M survival curve analysis

Figure 3 shows the prognostic value of mFI-11, TNM stage, and PNI for postoperative adverse outcomes. In comparison to the other two measures, the mFI-11 scale showed the best predictive value with regard to the area under the curve. In predicting 1-year mortality after surgery, mFI-11 had the highest area under the curve (0.731), followed by TNM stage (0.643), and the lowest was PNI (0.598). In predicting 6-mo mortality after surgery, mFI-11 had the highest area under the curve (0.759), followed by TNM stage (0.733), and the lowest was PNI (0.668). In terms of admission to ICU after surgery, mFI-11 also had the highest area under the curve (0.776), followed by TNM stage (0.659), and the lowest was PNI (0.559). In predicting anastomotic fistula after surgery, mFI-11 still had the highest area under the

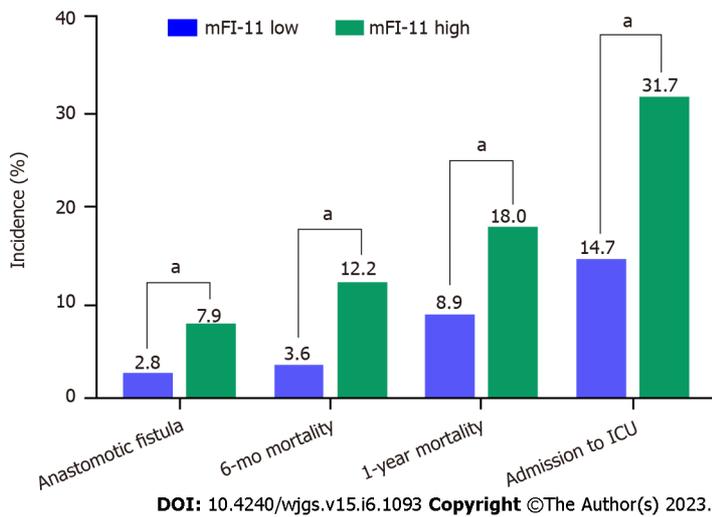


Figure 2 Incidence of postoperative intensive care unit admission, anastomotic fistula, death at 6 mo, and death at 1 year in both groups. ICU: Intensive care unit; mFI-11: 11-index modified frailty index. ^a*P* < 0.01.

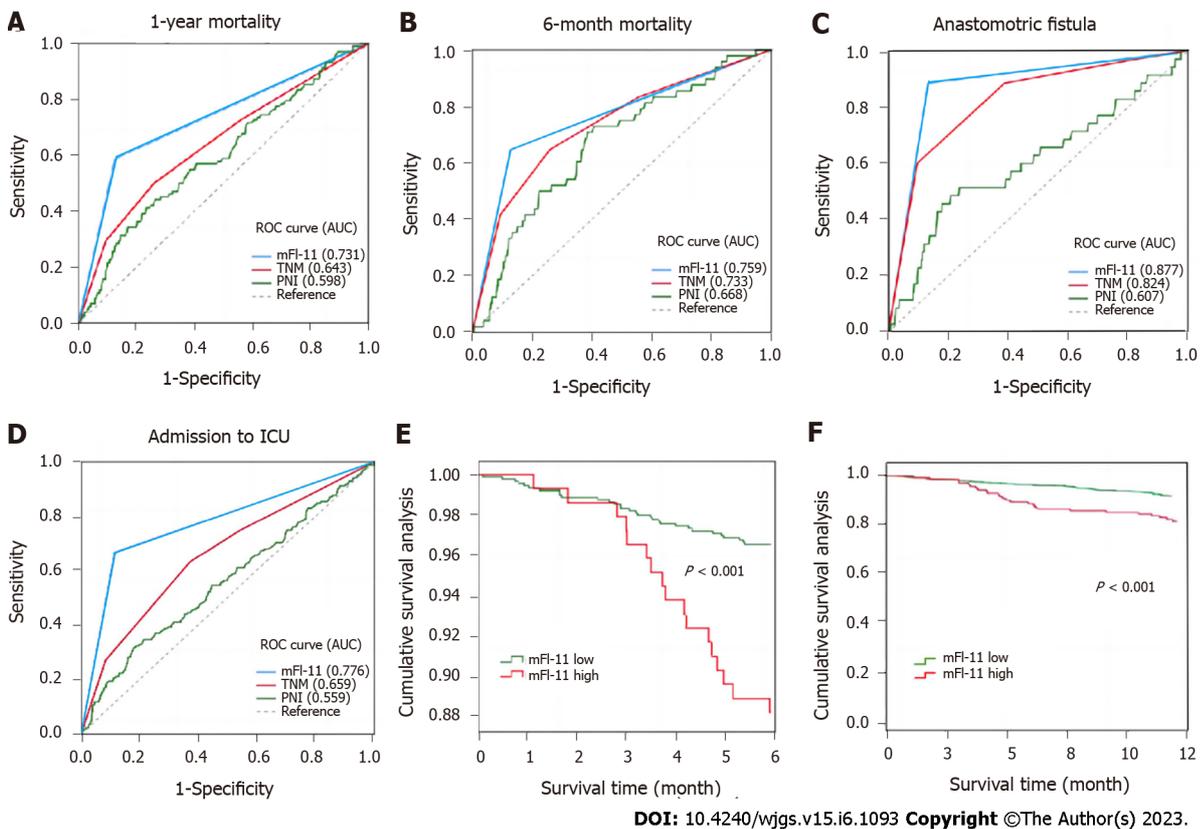


Figure 3 Prognostic value of 11-index modified frailty index, tumor-node-metastasis stage, and prognostic nutritional index for postoperative adverse outcomes. In comparison to the other two measures, the 11-index modified frailty index scale showed the best predictive value in terms of the area under the curve. A-F: The receiver operating characteristic (ROC) curves of 11-index modified frailty index (mFI-11), tumor-node-metastasis (TNM) stage, and prognostic nutritional index (PNI) in predicting 1-year mortality (A), 6-mo mortality (B), admission to intensive care unit (C), anastomotic fistula (D), survival at 6 mo (E), and survival at 1 year after surgery (F).

curve (0.877), followed by TNM stage (0.824), and the lowest was PNI (0.607). **Figure 3** also shows the K-M survival curves at 6 mo and 1 year after surgery between mFI-11^{High} and mFI-11^{Low} patients, and there was a significant difference between them (*P* < 0.001). **Supplementary Table 2** shows the area under the curve values of different variables in predicting admission to ICU, anastomotic fistula, 6-mo mortality, and 1-year mortality.

Risk factors for postoperative complications

Table 2 shows multivariate logistic regression analysis of adverse outcomes in elderly patients with GC after radical treatment. Multivariate analysis revealed mFI-11 as an independent predictive indicator for postoperative outcomes (1-year postoperative mortality: Adjusted odds ratio (aOR) = 4.432, 95% confidence interval (95%CI): 2.599-6.343, $P = 0.003$; admission to ICU: aOR = 2.058, 95%CI: 1.188-3.563, $P = 0.010$; anastomotic fistula: aOR = 2.852, 95%CI: 1.357-5.994, $P = 0.006$; 6-mo mortality: aOR = 2.438, 95%CI: 1.075-5.484, $P = 0.033$). Multivariate analysis also revealed TNM stage and PNI as independent predictive indicators for 1-year postoperative mortality (TNM stage III *vs* I: aOR = 1.423, 95%CI: 1.004-3.453, $P = 0.005$; TNM stage IV *vs* I: aOR = 2.422, 95%CI: 1.524-5.292, $P = 0.032$; PNI: aOR = 0.925, 95%CI: 0.902-0.964, $P = 0.021$).

Supplementary Tables 3-6 show univariate and multivariate logistic regression analyses of 1-year mortality, 6-mo mortality, anastomotic fistula, and admission to ICU, respectively.

DISCUSSION

To the best of our knowledge, this is the first study in China to demonstrate the relationship between preoperative frailty conditions and postoperative adverse outcomes (admission to ICU, anastomotic fistula, and 6-mo mortality) in patients over 65 years of age undergoing radical GC surgery. Similarly, for the first time, we compared the prognostic value of frailty (mFI-11), TNM stage, and PNI in postoperative outcomes in elderly GC patients. After comparing the prognostic value of mFI-11, TNM stage and PNI for the three postoperative adverse outcomes, we found that mFI-11 had the best prognostic value. It was also proved that frailty condition was an independent risk factor for the postoperative adverse outcomes, which provides some reference for clinicians to intervene in frailty condition during the perioperative period.

Radical surgery for GC is one of the best treatment methods for GC patients. However, as a kind of operation which causes great trauma to the body, radical surgery causes many adverse outcomes such as entering ICU, anastomotic fistula, and death[16]. Therefore, preoperative risk assessment is particularly important. In response to interest in accurate risk stratification, the surgical community has largely shifted from assessments based on subjective clinical judgment, such as the ASA classification, to more objective analytical approaches, including mFI-11[17]. Similarly, we sought to investigate the predictive capability of mFI-11 in a cohort of 1003 patients undergoing radical GC surgery. In our study, both the univariate and the multivariate analyses indicated that the mFI-11^{High} was an independent risk factor for postoperative complications. Alternatively, we found that mFI-11 had a better ability to identify high-risk patients and to predict postoperative outcomes when compared to TNM stage and PNI.

In this study, TNM stage was an independent risk factor for postoperative complications of GC. However, cancer is a systemic disease whose prognosis is not only dependent on the tumor itself, but also on the underlying physical condition as well as the physiological reserve. PNI served as a representative parameter of patient nutritional status in this study, and it has been used as a surrogate indicator of nutritional status in various neoplastic diseases. Different from other tumor patients undergoing surgery, GC patients often have loss of appetite and reduced oral food intake, and even some patients need parenteral nutrition support before surgery[18]. In this study, PNI was an independent risk factor for postoperative complications of GC. The deteriorating nutritional status may lead to a poor prognosis, and improving the nutritional status of patients with low preoperative PNI improves outcomes in the perioperative treatment of GC patients[19]. However, the simple use of nutritional status indicators was not included in the physiological reserve, so as expected, this study found that mFI-11 was better and more effective than PNI in terms of predicting 6-mo postoperative mortality, 1-year mortality, postoperative ICU admission, and the incidence of anastomotic fistula.

Frailty is becoming an increasingly established risk factor for adverse postoperative outcomes. Our results are consistent with previous studies in predicting adverse outcomes with perioperative frailty assessment (mFI-11)[20]. Jung *et al*[21] also found that mFI-11 scores in patients with lumbar lateral fusion were associated with urinary complications. The study conducted by Harris *et al*[22] found that frailty risk scores predicted morbidity and mortality in patients following selective endovascular repair of a reduced thoracic aortic aneurysm. In a previous study by Joseph *et al*[23], they also demonstrated that frailty as measured by mFI-11 was an accurate predictor of morbidity and mortality in patients undergoing complex abdominal wall reconstruction. Shi *et al*[24] found that mFI-11 was linked to complications and mortality in hip replacement patients.

The mFI-11 scale might be a useful tool for evidence-based decisions, providing proper patient management, and it is a sensitive tool to stratify and predict patients' long-term outcomes. Additionally, it provides a promising opportunity for more comprehensive and systematic preoperative risk assessment. This study should serve as a stimulus to further research in order to understand the importance and therapeutic value of frailty. Preoperative frailty condition identified by the mFI-11 scale could be used for clinical risk stratification to improve preoperative evaluation in elderly GC population. In contrast, identification of greater risks may lead to management changes, prompt consid-

Table 2 Multivariate logistic regression analysis of adverse outcomes in elderly patients with gastric cancer after radical treatment

Variable	1-year mortality			6-mo mortality			Anastomotic fistula			Admission to ICU		
	B	OR (95%CI)	P value	B	OR (95%CI)	P value	B	OR (95%CI)	P value	B	OR (95%CI)	P value
Age, > 75 yr vs 65-75 yr							0.883	2.418 (1.202-4.865)	0.013	0.914	2.495 (1.723-3.613)	< 0.001
Serum albumin, g/L	-0.532	0.923 (0.900-0.954)	0.023	0.013	0.936 (0.325-0.999)	0.002	-0.881	0.907 (0.484-1.696)	0.759	-0.018	0.718 (0.439-0.909)	0.012
PNI	-0.251	0.925 (0.902-0.964)	0.021	0.041	0.932 (0.554-0.942)	0.014	0.062	0.567 (0.214-1.481)	0.846	-0.019	0.719 (0.438-0.902)	0.041
TNM stage, III vs I	0.324	1.423 (1.004-3.453)	0.005	0.365	1.122 (0.798-2.525)	0.424						
TNM stage, IV vs I	0.683	2.422 (1.524-5.292)	0.032	0.415	1.041 (0.698-1.464)	0.221				0.345	1.356 (1.008-4.637)	0.031
ASA grade, II vs I	1.134	1.412 (1.053-2.637)	0.042	0.643	1.001 (0.888-2.642)	0.471				0.980	1.643 (0.463-1.976)	0.318
ASA grade, III vs I	1.124	2.577 (1.656-3.487)	0.011				0.214	1.533 (1.213-4.743)	0.003	0.506	2.344 (1.796-4.785)	0.022
ASA grade, IV vs I	1.412	1.456 (1.077-3.747)	0.041							0.602	2.865 (1.092-3.853)	0.018
Gastrectomy, PG vs TG										0.671	0.312 (0.111-1.764)	0.357
mFI-11 ^{High} vs mFI-11 ^{Low}	0.931	4.432 (2.599-6.343)	0.003	0.887	2.438 (1.075-5.484)	0.033	1.048	2.852 (1.357-5.994)	0.006	0.722	2.058 (1.188-3.563)	0.010

P less than 0.05 is marked as bold. ASA: American Society of Anesthesiologists; BMI: Body mass index; TNM: Tumor- node-metastases; DG: Distal partial gastrectomy; TG: Total gastrectomy; PG: Proximal partial gastrectomy; PNI: Prognostic nutritional index; mFI-11:11-item, modified frailty index; IGA: Intravenous general anesthesia; IIA: Intravenous inhalation anesthesia.

eration of close observation, and/or reducing the threshold for intervention. Radical GC surgery is a complex procedure that requires detailed preoperative risk assessment to reduce patient risk and optimize patient benefit and resource utilization[25].

This study has several important limitations. First, this study was a single-center retrospective study. The study center is conducting a large, multicenter, prospective, frailty-scale evaluation study to validate the value of frailty in predicting adverse postoperative outcomes. Second, the study population was elderly patients with elective radical GC, so the study results cannot be directly generalized to the entire surgical population. Third, despite adjustment for potential confounders, there may be other variables not considered, such as tumor size, so we must acknowledge the effect of unmeasured confounders.

CONCLUSION

In summary, high risk of frailty assessed by mFI-11 based on medical record data has been confirmed to be significantly associated with anastomotic fistula, mortality, and ICU admission after radical GC surgery in elderly patients in China. Preoperative evaluation of frailty may provide useful prognostic information for elderly patients undergoing radical GC surgery. This simple risk score tool may enable

improved risk assessment and patient selection prior to elective radical GC surgery.

ARTICLE HIGHLIGHTS

Research background

Preoperative evaluation of frailty is limited to a few surgical procedures. However, the evaluation in Chinese elderly gastric cancer (GC) patients remains blank.

Research motivation

To validate and estimate the prognostic value of the 11-index modified frailty index (mFI-11) for postoperative anastomotic fistula, intensive care unit (ICU) admission, and long-term survival in elderly patients over 65 years of age undergoing radical GC.

Research objectives

To explore the feasibility of mFI-11 in predicting adverse outcomes after radical GC resection in elderly patients.

Research methods

A retrospective cohort study was conducted on patients over 65 years of age who received curative gastrectomy with D2 Lymph node dissection for GC. The primary outcome was 1-year all-cause mortality. The secondary outcomes were admission to ICU, anastomotic fistula, and 6-mo mortality. Survival curves between the two groups were compared, and univariate and multivariate regression analyses were performed to explore the relationship between preoperative frailty and postoperative complications in elderly patients undergoing radical GC.

Research results

A total of 1003 patients were included, of which 13.86% (139/1003) were defined as having mFI-11^{High} and 86.14% (864/1003) as having mFI-11^{Low}. mFI-11^{High} patients had higher rates of 1-year mortality, 6-mo mortality, anastomotic fistula, and admission to ICU than the mFI-11^{Low} group. Multivariate analysis revealed mFI-11 as an independent predictive indicator for 1-year postoperative mortality, 6-mo mortality, anastomotic fistula, and admission to ICU. mFI-11 showed better prognostic efficacy in predicting 1-year postoperative mortality [area under the ROC curve (AUROC): 0.731], 6-mo mortality (AUROC: 0.759), anastomotic fistula (AUROC: 0.877), and admission to ICU (AUROC: 0.776).

Research conclusions

Frailty as measured by mFI-11 could provide prognostic information for 1-year postoperative mortality, admission to ICU, anastomotic fistula, and 6-mo mortality in patients over 65 years old undergoing radical GC.

Research perspectives

Well-designed multi-center prospective randomized controlled studies are still needed.

FOOTNOTES

Author contributions: Xu ZY and Hao XY contributed equally to this work; Xu ZY, Hao XY, and Wang XX designed the experiments; Wu D performed the experiments; Xu ZY and Hao XY collected the data; Wu D and Song QY analyzed the data; Xu ZY, Hao XY, and Wang XX wrote the initial draft; Wu D and Song QY modified the manuscript.

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