

# World Journal of *Gastrointestinal Surgery*

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- 1926** Novel magnetic compression technique for the treatment of postoperative anastomotic stenosis in rectal cancer: A case report  
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Retrospective Study

# Correlation between postoperative chemotherapy regimen and survival in patients with resectable gastric adenocarcinoma accompanied with vascular cancer thrombus

Ze-Feng Yang, Zhuan-Xia Dong, Chen-Jie Dai, Li-Zheng Fu, Hong-Mei Yu, Yu-Sheng Wang

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## Abstract

### BACKGROUND

Patients with resectable gastric adenocarcinoma accompanied by vascular cancer thrombus (RGAVCT) have a poor prognosis, with a 5-year survival rate ranging from 18.42%-53.57%. These patients need a reasonable postoperative treatment plan to improve their prognosis.

### AIM

To determine the most effective postoperative chemotherapy regimen for patients with RGAVCT.

### METHODS

We retrospectively collected the clinicopathological data of 530 patients who underwent radical resection for gastric cancer between January 2017 and January



2022 and who were pathologically diagnosed with gastric adenocarcinoma with a choroidal cancer embolus. Furthermore, we identified the high-risk variables that can influence the prognosis of patients with RGAVCT by assessing the clinical and pathological features of the patients who met the inclusion criteria. We also assessed the significance of survival outcomes using Mantel-Cox univariate and multivariate analyses. The subgroups of patients with stages I, II, and III disease who received single-, dual-, or triple-drug regimens following surgery were analyzed using SPSS 25.0 and the ggplot2 package in R 4.3.0.

## RESULTS

In all, 530 eligible individuals with RGAVCT were enrolled in this study. The median overall survival (OS) of patients with RGAVCT was 24 months, and the survival rates were 80.2%, 62.5%, and 42.3% at 12, 24, and 59 months, respectively. Preoperative complications, tumor size, T stage, and postoperative chemotherapy were identified as independent factors that influenced OS in patients with RGAVCT according to the Cox multivariate analysis model. A Kaplan-Meier analysis revealed that chemotherapy had no effect on OS of patients with stage I or II RGAVCT; however, chemotherapy did have an effect on OS of stage III patients. Stage III patients who were treated with chemotherapy consisting of dual- or triple-agent regimens had better survival than those treated with single-agent regimens, and no significant difference was observed in the survival of patients treated with chemotherapy consisting of dual- or triple-agent regimens.

## CONCLUSION

For patients with stage III RGAVCT, a dual-agent regimen of postoperative chemotherapy should be recommended rather than a triple-agent treatment, as the latter is associated with increased frequency of adverse events.

**Key Words:** Vascular cancer embolism; Postoperative chemotherapy regimen; Gastric adenocarcinoma; Risk factors; Survival

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**Core Tip:** In patients with resectable gastric adenocarcinoma accompanied by vascular cancer thrombus (RGAVCT), postoperative chemotherapy has an independent effect on overall survival and may even improve survival. Patients with stage I and II RGAVCT should not receive postoperative chemotherapy, and low-toxicity single-agent therapy is advised even in the presence of high-risk variables. For patients with stage III RGAVCT, a dual-agent regimen of postoperative chemotherapy should be recommended rather than a triple-agent treatment, as the latter is associated with increased risks.

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## INTRODUCTION

According to the 2020 Tumor Report[1], gastric cancer (GC) ranked fourth among all cancers according to the number of new cases, with approximately 1.1 million cases per year. GC ranked third in terms of mortality rate, with approximately 760000 deaths per year. GC is an important life-threatening disease and one of the most common malignant tumors worldwide. China ranks second and third in terms of new cases and deaths related to GC, respectively[2]. Studies by Zhang[3] and the Asian Cancer Research Group[4] marked significant advancements in the molecular typing of GC, thereby leading to enhanced medical treatment strategies. For stage III GC, the 5-year survival rate following surgery is 34.8%-54.6%[5], and radical surgical resection remains the preferred course of treatment. When tumor cells infiltrate the interior of lymphatic or vascular vessels, which are composed of endothelial cells, the condition is referred to as lymphatic and blood vessel invasion (LBVI)[6]. The literature indicates a 5-year survival rate of 18.42%-53.57% for patients with postoperatively resectable stomach cancer and pathologically identified vascular thrombus, which indicates a poor prognosis[7]. Consequently, the presence of vascular thrombus plays a significant role in the poor prognosis of patients with stomach cancer. Currently, few exploratory investigations on vascular tumor thrombus in gastric adenocarcinoma have been published, and thus the clinicopathological characteristics of this condition remain unknown. To identify alternative therapies to increase the survival of patients with resectable gastric adenocarcinoma accompanied by vascular cancer thrombus (RGAVCT), we retrospectively examined the clinical and pathological features of 530 patients with RGAVCT and conducted pertinent survival analyses. This manuscript was written according to the STROBE checklist.

## MATERIALS AND METHODS

### Clinical information

Clinicopathological data were retrospectively collected from 530 patients (107 women and 423 men) who underwent radical surgery for GC at Shanxi Cancer Hospital between January 2017 and January 2022 and who were pathologically diagnosed with stomach adenocarcinoma with a vascular cancer embolus. Patient ages ranged from 28–83 years (median, 63 years). This study was approved by the Clinical Research Ethics Committee of Shanxi Cancer Hospital (approval number: KY2023010). During their first visit to the hospital, all patients provided written informed consent for the collection and release of their medical information.

**Inclusion and exclusion criteria:** The inclusion criteria were as follows: (1) Radical resection of GC at Shanxi Cancer Hospital; (2) postoperative pathological confirmation of gastric adenocarcinoma or adenocarcinoma of the gastroesophageal junction; (3) postoperative pathological evidence of vascular cancer thrombus; (4) clinical stage I, II, or III disease; and (5) availability of complete clinicopathological data. The exclusion criteria were as follows: (1) Presence of other tumors; (2) nonradical resection, such as surgery with positive margins or palliative surgery; and (3) incomplete or unavailable pathological data.

**Staging and Ki-67 positivity:** Pathological and histological staging was performed according to the 2019 version of the World Health Organization Classification of Tumors of the Digestive System. Ki-67 positivity < 30% was considered low expression, while Ki-67 positivity ≥ 30% was considered high expression.

**Follow-up:** Regular gastroenterology outpatient reviews, hospitalization, and telephone interviews were used for patient survival follow-up. The deadline for follow-up was March 2023. Overall survival (OS) was defined as the time from the date of surgery to the date of death or the end of follow-up.

### Information collection

**Clinical information:** Patient information, including sex, age at the time of surgery, medical history, family history, preoperative complications, surgical procedures, and postoperative chemotherapy, was collected.

**Pathological information:** The pathology report included information regarding the location and size of the tumor, the degree of tumor differentiation, the Lauren classification, LBVI, neural invasion, the depth of invasion, the total number of cleared lymph nodes, and immunohistochemistry findings.

**Research participants and chemotherapy regimens:** To ensure the authenticity and reliability of our results, we collected information on patients who received postoperative adjuvant chemotherapy at our hospital.

### Statistical analysis

SPSS (version 25.0; IBM, Armonk, NY) and R 4.3.0 (R Foundation, Vienna, Austria) were used for the statistical analysis. The rank-sum test was used to evaluate the skewed distributions, which are expressed as the mean and standard deviation of the quantitative data. Mantel-Cox univariate regression analysis was used to identify possible prognostic factors. The clinicopathological variables that affected survival time were then analyzed using a multivariate Cox regression model to identify significant factors that might affect the prognosis of patients with RGAVCT. The Kaplan-Meier method was used to calculate the survival rates, and the log-rank test was used for intergroup comparisons of the survival curves. The survival curves were compared between groups using R 4.3.0. In R 4.3.0, the forest plot of the factors that influenced the survival of patients with RGAVCT was plotted using the “survival” and “forest plot” packages; the Kaplan-Meier survival curves for patients with RGAVCT were drawn using the “ggplot2” and “survminer” programs. Statistical significance was established at  $P < 0.05$ . The statistical methods used in this study were reviewed by Professor Yu HM from the Department of Health Statistics, Shanxi Medical University.

## RESULTS

### Clinicopathologic features of patients with RGAVCT

The 530 patients with RGAVCT who met the inclusion criteria ranged in age from 28–83 (median, 63) years (Table 1). A 4:1 male-to-female ratio was noted, with 423 men and 107 women. A total of 9.2% of patients had a family history of tumors, and 86.4% of patients had no preoperative complications. For those patients who did experience preoperative complications, 7.7%, 1.9%, 1.1%, and 2.8% experienced gastrointestinal obstruction, gastrointestinal hemorrhage, other complications (such as perforation, gastric retention, and anemia), and multiple complications, respectively. Open surgery was performed in 61.9% of patients, laparoscopic surgery in 33.8%, and combined thoracic and abdominal surgery in 4.3%. Postoperative chemotherapy was administered to approximately 74.3% of patients.

According to the Union for International Cancer Control TNM staging system (8<sup>th</sup> edition), 10 patients (1.9%) were categorized as stage IB, 43 (8.1%) as stage IIA, 80 (15.1%) as stage IIB, 132 (24.9%) as stage IIIA, 171 (32.3%) as stage IIIB, and 94 (17.7%) as stage IIIC. The RGAVCT tumor sites were mainly distributed in the proximal (54%), distal (27.2%), and gastric bodies (18.9%). Tumors were predominantly poorly differentiated (54.3%), intermediate-poorly differentiated (35.5%), and moderately differentiated (10.2%); none were well differentiated.

**Table 1 Univariate analysis of the demographic, clinical, and pathological risk variables in 530 patients with resectable gastric adenocarcinoma accompanied by vascular cancer thrombus**

Characteristic	n (%)	$\chi^2$	P value
Age, yr			
< 60	211 (39.8)	5.943	0.015
≥ 60	319 (60.2)		
Sex			
Male	423 (79.8)	7.533	0.006
Female	107 (20.2)		
Past history			
No	289 (54.5)	3.76	0.052
Yes	241 (45.5)		
Family history			
No	479 (90.4)	4.711	0.030
Yes	51 (9.6)		
Preoperative complications			
No	458 (86.4)	1.982	0.037
Digestive tract obstruction	41 (7.7)		
Alimentary tract hemorrhage	10 (1.9)		
Others <sup>1</sup>	6 (1.1)		
≥ 2 complications	15 (2.8)		
Surgical method			
Open abdominal	328 (61.9)	1.853	0.396
Laparoscopy	179 (33.8)		
Joint thoracoabdominal	23 (4.3)		
Chemotherapy			
No	136 (25.7)	63.834	<0.001
Yes	394 (74.3)		
Tumor site			
Proximal	286 (54)	2.217	0.330
Distal	144 (27.2)		
Body	100 (18.9)		
Differentiation			
Moderate	54 (10.2)	5.742	0.057
Moderate-poor	188 (35.5)		
Poor	288 (54.3)		
Lauren classification			
Diffused type	182 (34.3)	11.859	0.008
Intestinal type	62 (11.7)		
Mixed type	252 (47.5)		
NA	34 (6.4)		
Neural invasion			
Absence	247 (46.6)	5.899	0.015

Presence	283 (53.4)		
Tumor size, cm			
< 5	231 (43.6)	8.976	0.003
≥ 5	299 (56.4)		
HER2 expression			
Negative	458 (86.4)	0.495	0.482
Positive	72 (13.6)		
MMR status			
dMMR	14 (2.6)	0.229	0.633
pMMR	516 (97.4)		
Ki-67 expression			
Low	8 (1.5)	6.019	0.014
High	522 (98.5)		
T stage			
2	44 (8.5)	25.459	< 0.001
3	374 (70.6)		
4a	93 (17.5)		
4b	18 (3.4)		
N stage			
0	37 (7)	42.8	< 0.001
1	104 (19.6)		
2	137 (25.8)		
3a	158 (29.8)		
3b	94 (17.7)		
Stage			
IB	10 (1.9)	62.765	< 0.001
IIA	43 (8.1)		
IIB	80 (15.1)		
IIIA	132 (24.9)		
IIIB	171 (32.3)		
IIIC	94 (17.7)		

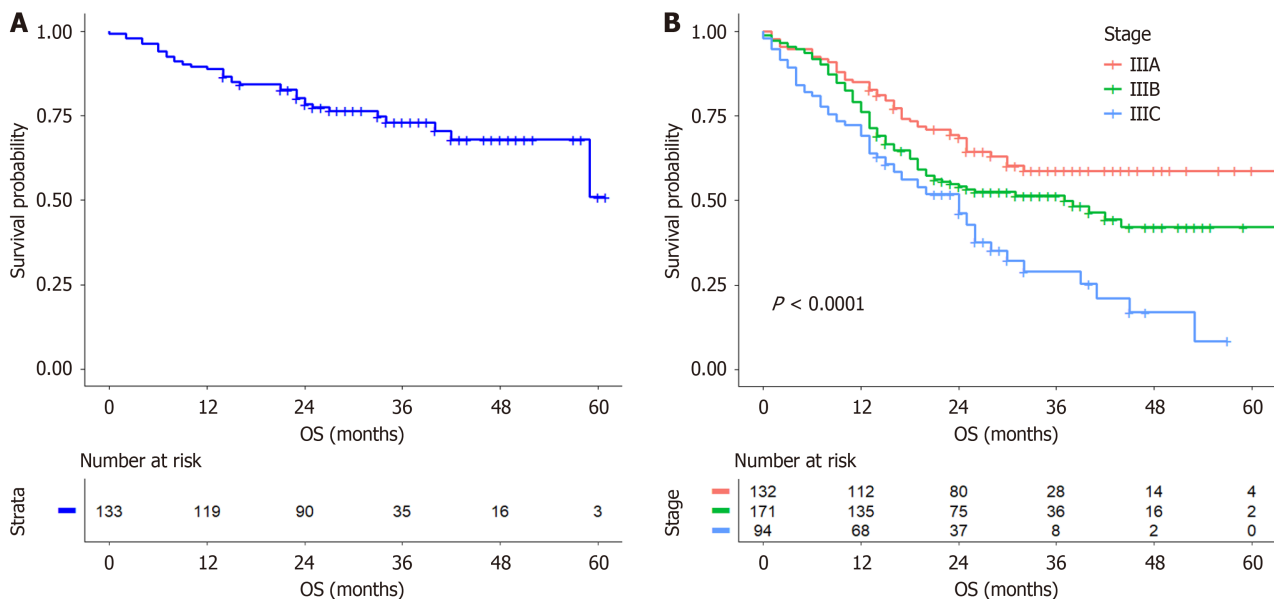
<sup>1</sup>Others includes perforation, gastric retention and anemia.

dMMR: Defective mismatch repair; pMMR: Proficient mismatch repair.

The Lauren classification was predominantly mixed (47.5%) or diffused (34.3%), while the intestinal type was less frequent (11.7%). Neural invasion was observed in 53.4% of the patients. Tumors > 5 cm were found in 56.4% of the patients. Immunohistochemistry indicated Her-2 positivity (3+ or 2+ fluorescent in situ hybridization positivity) in approximately 13.6% of the patients. Moreover, mismatch repair proteins (MLH1, PMS2, MSH2, and MSH6) were absent in 2.6% and were expressed in 97.4% of the patients. Ki-67 was highly expressed in 98.5% of the patients.

### Survival analysis of patients with RGAVCT

The median OS (mOS) of patients with RGAVCT was 24 months, with survival rates of 80.2%, 62.5%, 54.8%, and 42.3% at 12, 24, 37, and 59 months, respectively. The postoperative chemotherapy group had an mOS of 25 months, and the survival rates were 86.8%, 71.3%, 64.2%, and 52.8% at 12, 24, 37, and 53 months, respectively. The mOS was 15 months in the group that did not receive chemotherapy, and the survival rates were 61%, 38.1%, 28.5%, and 19% at 12, 24, 34, and 59 months, respectively. Patients with stage I and II cancer had an mOS of 27 months, with survival rates of 89.5%, 80%, 74.6%, and 52.2% at 12, 24, 34, and 59 months, respectively (Figure 1A). The mOS of patients with stage III cancer was 23 months, with survival rates of 77.8%, 57.8%, 49.5%, and 40.1% at 12, 24, 37, and 53 months, respectively. The best survival



**Figure 1** Survival curve of resectable gastric adenocarcinoma accompanied by vascular cancer thrombus patients. A: Stage I and II; B: Stage III. OS: Overall survival.

rate was observed in patients with stage IIIA cancer, followed by those with stage IIIB cancer, while the worst survival rate was observed in patients with stage IIIC cancer (Figure 1B).

#### Analysis of the factors influencing survival of patients with RGAVCT

The univariate analysis by Mantel-Cox regression revealed significant differences ( $P < 0.05$ ) in age, sex, family history, preoperative complications, postoperative chemotherapy, Lauren classification, neural invasion status, tumor size, Ki-67 expression, T and N stage, and clinical stage, and these factors were significantly correlated with the OS of patients with RGAVCT. A multivariate Cox analysis of the significant influencing factors revealed that preoperative complications ( $P = 0.035$ ), postoperative chemotherapy [ $P < 0.001$ ; hazard ratio (HR) = 0.35; 95% confidence interval (CI) = 0.26-0.46], tumor size ( $P = 0.035$ ; HR = 1.36; 95%CI = 1.02-1.80), and T stage ( $P = 0.005$ ) were independent factors that affected OS (Figure 2).

#### RGAVCT postoperative chemotherapy regimen and survival correlation analysis

Of the 394 patients with RGAVCT who were administered postoperative adjuvant chemotherapy, 323 received chemotherapy at our institution (23 received a single-agent regimen, 272 received a dual-agent regimen, and 28 received a triple-agent regimen), and 71 received chemotherapy outside our hospital.

The univariate analysis revealed no significant difference between postoperative chemotherapy and survival in patients with stage I and II RGAVCT ( $P = 0.527$ ). Preoperative complications, postoperative pathological neural invasion, and Ki-67 expression were factors that were found to influence the survival of patients with stage I and II RGAVCT ( $P < 0.05$ ).

The Cox multivariate analysis revealed that preoperative complications ( $P = 0.021$ ), neural invasion ( $P = 0.02$ ; HR = 2.47; 95%CI = 1.16-5.28), and Ki-67 expression ( $P = 0.007$ ; HR = 0.05; 95%CI = 0.01-0.44) were independent factors found to influence the survival of patients with stage I and II RGAVCT (Table 2). However, postoperative chemotherapy did not affect the OS of high-risk patients with stage I and II RGAVCT ( $P = 0.653$ ).

The Kaplan-Meier analysis revealed that postoperative chemotherapy affected the OS of patients with stage III RGAVCT ( $P < 0.001$ ) (Figure 3A). Furthermore, compared with patients treated with a single-agent regimen, individuals who were treated with chemotherapy consisting of dual- or triple-agent regimens had higher survival rates ( $P = 0.047$  and  $P = 0.034$ ) (Figure 3B and C), and no significant difference was observed between the survival of patients treated with dual-agent regimens and that of those treated with triple-agent regimens ( $P = 0.646$ ) (Figure 3D).

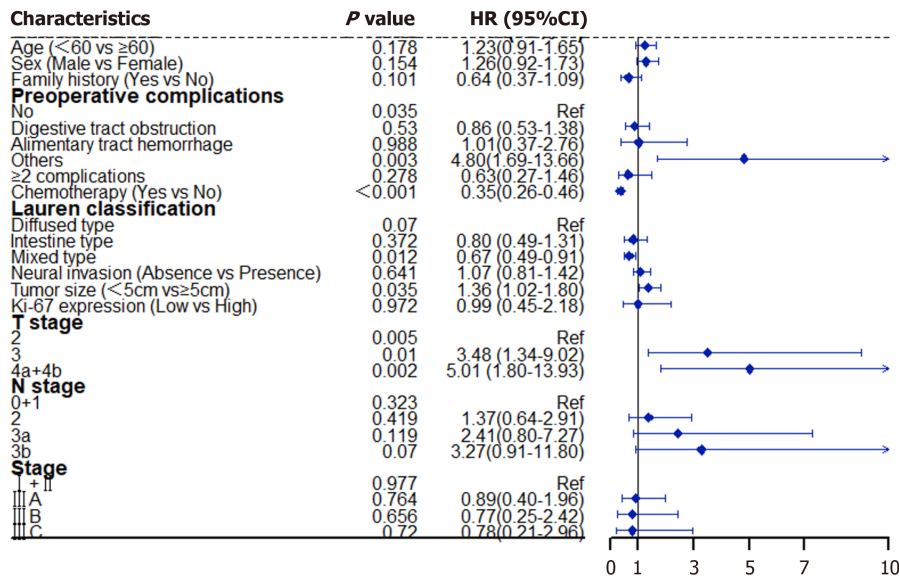
## DISCUSSION

The aim of this study was to determine the most effective postoperative chemotherapy regimen for patients with RGAVCT. According to the analysis, no significant survival difference was observed between patients with stage III RGAVCT treated with double-drug regimens and those treated with triple-drug regimens, but their survival rates were better than those who received single-drug regimens. For patients with stage III RGAVCT, a dual-agent regimen of postoperative chemotherapy should be recommended rather than a triple-agent treatment, as the latter is associated with increased adverse events.

**Table 2** Univariate and multivariate analyses of 133 patients with stage I and stage II resectable gastric adenocarcinoma accompanied by vascular cancer thrombus to determine which clinicopathological characteristics are risk factors

Characteristic	N	Univariate analysis		Multivariate analysis	
		$\chi^2$	P value	HR (95%CI)	P value
Preoperative complications					
No	115	27.724	< 0.001	1	0.021
Digestive tract obstruction	4			2.15 (0.50-9.32)	0.304
Alimentary tract hemorrhage	1			2.90 (0.38-22.41)	0.307
Others <sup>1</sup>	3			7.07 (1.91-26.15)	0.003
Neural invasion					
Absence	73	10.014	0.002	1	
Presence	50			2.47 (1.16-5.28)	0.02
Ki-67 expression					
Low	1	5.58	0.018	1	
High	122			0.05 (0.01-0.44)	0.007

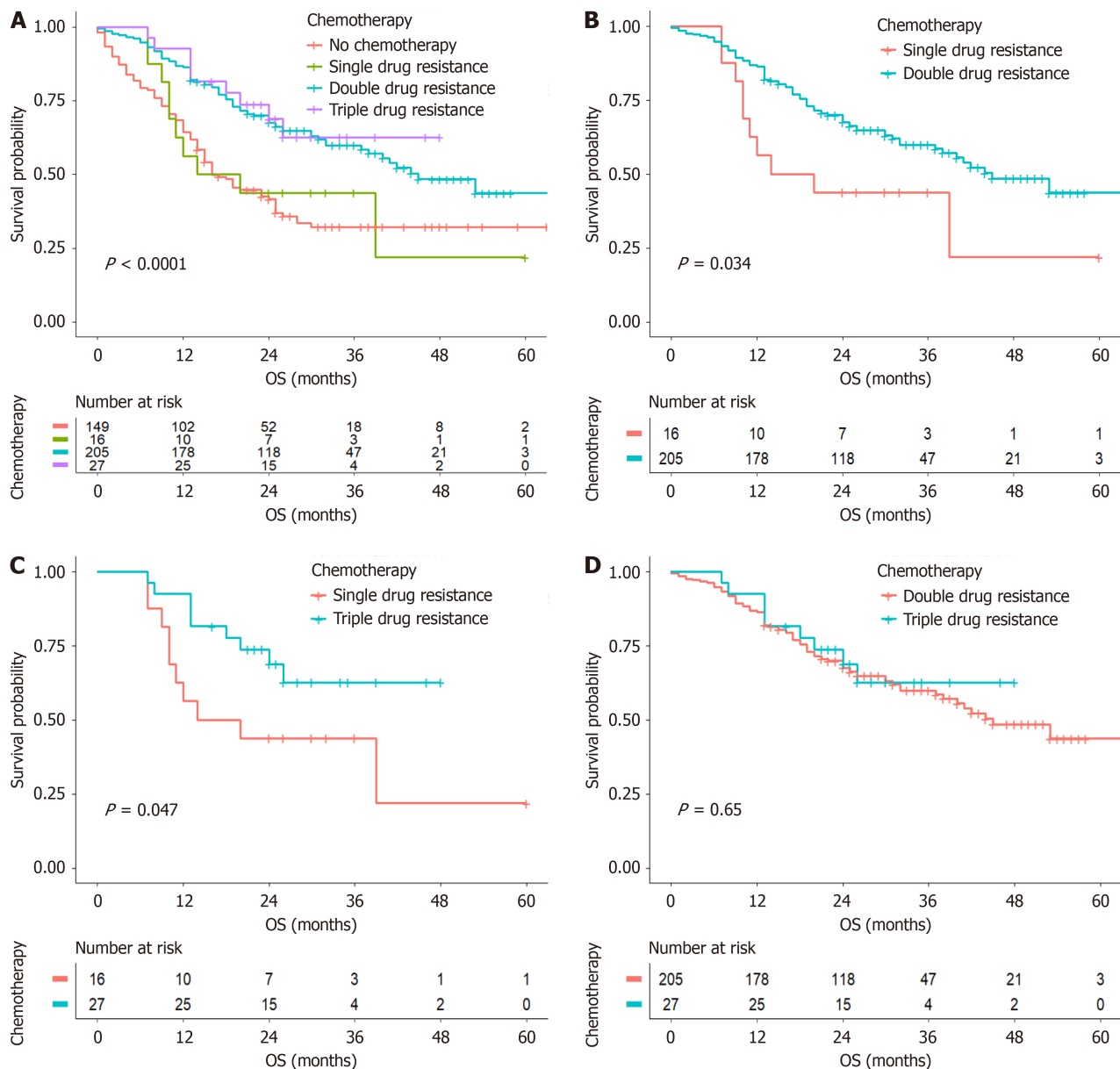
<sup>1</sup>Others includes perforation, gastric retention and anemia.  
HR: Hazard ratio; CI: Confidence interval.



**Figure 2** Multivariate analysis of risk factors in 530 patients with resectable gastric adenocarcinoma accompanied by vascular cancer thrombus.

GC is a life-threatening disease and is one of the primary causes of cancer-related death worldwide. The introduction of novel anticancer medications, neoadjuvant radiation, adjuvant chemotherapy, and late-stage palliative care are among the numerous advancements in the systemic treatment of GC. These measures have significantly increased the survival rates of patients with GC. However, high postoperative recurrence and metastasis rates adversely affect the survival of patients with GC. The postoperative clinicopathological features of GC are also the primary prognostic factors associated with this disease. In a study by Chen *et al*[8], the depth of tumor infiltration, extent of lymph node metastasis, extent of distant metastasis, and pathological score were used to predict the prognosis and OS of patients with GC. The impact of vascular cancer embolism on the prognosis of malignant tumors has received considerable attention because of detailed research on tumor prognostic variables and the concept of micrometastasis[9,10]. Vascular cancer emboli are tumor cells that form aggregates with fibrin clots, coexist with erythrocytes, infiltrate the endothelial cell space arrangement of the surrounding tissue in the absence of erythrocytes, or invade the smooth muscle cell space arrangement[11,12]. Torre *et al*[13] reported a 2:1 male-to-female ratio in the global incidence of GC in 2012, while Sung *et al*[1] reported that the global incidence of GC in 2020 was approximately 7.2% for men and 4.4% for women. These studies show that the





**Figure 3** Comparison of chemotherapy schemes in 323 patients with stage III resectable gastric adenocarcinoma accompanied by vascular cancer thrombus. A: Comparison of chemotherapy schemes for Stage III patients; B: Comparison of single drug and double drug resistances; C: Comparison of single drug and triple drug resistances; D: Comparison of double drug and triple drug resistances. OS: Overall survival.

number of men with GC is greater than that of women. The male-to-female ratio of patients with RGAVCT in this study was 4:1, which was much higher than the global male-to-female ratio of GC patients. Consequently, vascular cancer emboli are more likely to occur in males with GC.

Regarding the baseline characteristics of patients with RGAVCT, our study revealed that the type of surgery (open, laparoscopic, or combined thoracoabdominal) had no effect on OS. Moreover, we found that surgeons involved in clinical assessments selected the appropriate surgical approach based on the specific conditions of the patients. In more than half (53.4%) of the patients with RGAVCT and concomitant neural invasion, we found that vascular cancer embolus and neural invasion were likely to occur simultaneously. Among the patients with RGAVCT who were analyzed, 10 had stage IB RGAVCT, 123 had stage II RGAVCT, and 397 had stage III RGAVCT, which accounted for 74.9% of all patients. This indicates that vascular cancer embolisms occurred more often in patients with advanced GC. The median survival time (mOS = 23 months) and survival rates at 12 months (77.8%), 24 months (57.8%), 34 months (49.5%), and 53 months (40.1%) of patients with stage III RGAVCT were significantly lower than those of patients with stages I and II RGAVCT (mOS = 27 months; 12 months, 89.5%; 59 months, 52.2%).

The risk factors for GC include many immutable variables, such as age[14], sex, and race/ethnicity. Additionally, some modifiable risk factors, such as *Helicobacter pylori* infection[15], smoking[16], and high nitrate and nitrite diets, have also been identified. Several known hereditary cancer syndromes are associated with GC, including hereditary diffuse GC (CDH1) syndrome, the most strongly associated syndrome, which occurs in approximately 80% of patients[17]. The multivariate analysis identified preoperative complications, postoperative chemotherapy, tumor size, and T stage as independent factors that affect the OS of patients with RGAVCT, with postoperative chemotherapy as the intervening factor.

In addition, a previous study[18] showed that lymph node metastasis in early GC can be predicted using nomograms, decision trees, and deep learning models. To better understand the prognostic factors of patients with RGAVCT, the derived prognostic elements can be utilized to construct a deep learning model. This model can then be applied to validate these factors using external databases.

In this study, the mOS was 25 months in the chemotherapy group, which was greater than that in the nonchemotherapy group (15 months), which indicates that chemotherapy could prolong the survival of patients with RGAVCT. Several studies[19-21] have suggested that postoperative chemotherapy can improve the prognosis of patients with GC. However, postoperative chemotherapy is the only intervening factor among the independent factors that affect the OS of patients with RGAVCT, and a rational postoperative chemotherapy regimen can further improve the prognosis of these patients. A clinical consensus[22] has been established that postoperative adjuvant therapy should be recommended for patients who undergo D2 radical surgery and who do not receive preoperative treatment for postoperative pathological stage II and III progressive GC. In this study, 530 patients were evaluated based on clinical stage, and we found that postoperative chemotherapy did not affect the OS of patients with stage I and II RGAVCT. We further investigated whether postoperative chemotherapy influenced the survival of high-risk patients with stage I and II RGAVCT. We found that preoperative complications, postoperative pathological neural invasion, and Ki-67 expression were independent factors that affected the survival of patients with stages I and II RGAVCT according to the univariate and multivariate analyses. However, the OS of patients with stage I and II RGAVCT who had a combination of high-risk factors was not affected by postoperative chemotherapy.

We explored the effect of postoperative chemotherapy on the OS of patients with stage III RGAVCT ( $P < 0.001$ ) and discovered a substantial difference in survival between patients who received postoperative chemotherapy and those who did not. The recent JACCRO GC-07 study[23], which investigated chemotherapy regimens and clinical outcomes, showed that the continuation of an oral S-1 monotherapy regimen (DS sequential S-1) after six cycles of postoperative docetaxel combined with S-1 improved the survival of patients with stage III GC compared with S-1 alone (3-year recurrence-free survival: S-1/docetaxel group, 65.9% *vs* S-1 group, 49.6%;  $P = 0.0007$ ). Moreover, combination therapy inhibited hematologic, lymphatic, and peritoneal recurrence. An analysis of the effects of dosing regimens on the survival of patients with stage III RGAVCT who received postoperative adjuvant chemotherapy at our institution showed that postoperative chemotherapy prolonged survival, that dual- and triple-agent regimens resulted in an equal survival benefit, and that both were better than a single-agent regimen. The CLASSIC study[24] used capecitabine combined with oxaliplatin in a dual-agent adjuvant chemotherapy regimen for advanced GC. The 5-year disease-free survival rate (68%) and 5-year OS rate (78%) with this regimen were better than those in the observation group (53% and 69%, for the 5-year disease-free survival and the 5-year OS, respectively). Therefore, postoperative chemotherapy for advanced GC should involve a dual-agent regimen of capecitabine and oxaliplatin. Another study[25] showed that the XELOX double-agent regimen was as effective as both regimens in the first-line treatment of advanced GC, unlike the EOX triple-agent regimen. This study, for the first time, established the optimal two-drug chemotherapy strategy for patients with stage III RGAVCT and identified the clinical features of patients with RGAVCT. However, our chemotherapeutic program design was not standardized, and the sample size was small, which limits the accuracy of the data in this study. A deep learning model using external databases for predicting variables will be created in the future to confirm the predictions for patients with RGAVCT. Long-term, randomized, controlled clinical research is also necessary to investigate the effect of chemotherapy regimens on the survival of patients with RGAVCT.

## CONCLUSION

Postoperative chemotherapy has an independent effect on OS in patients with RGAVCT and can increase survival. However, chemotherapy administered after surgery had little effect on the OS of patients with stage I and II RGAVCT. Moreover, triple-agent treatment is associated with more adverse events than other forms of treatment. Therefore, we recommend that patients with stage II RGAVCT receive dual-agent chemotherapy. The clinical implications and future scope are clear.

## FOOTNOTES

**Author contributions:** Wang YS, Yu HM and Yang ZF designed the research study; Yang ZF prepared the materials; Yang ZF, Dong ZX, Dai CJ, Fu LZ collected the data; Wang YS, Yu HM and Yang ZF analyzed the data; Yang ZF wrote the manuscript and edited it; Wang YS contributed to the writing review; Wang YS and Yang ZF completed the writing-final draft; Wang YS contributed fund support.

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## REFERENCES

- 1 Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin* 2021; **71**: 209-249 [PMID: 33538338 DOI: 10.3322/caac.21660]
- 2 Cao W, Chen HD, Yu YW, Li N, Chen WQ. Changing profiles of cancer burden worldwide and in China: a secondary analysis of the global cancer statistics 2020. *Chin Med J (Engl)* 2021; **134**: 783-791 [PMID: 33734139 DOI: 10.1097/CM9.0000000000001474]
- 3 Zhang W. TCGA divides gastric cancer into four molecular subtypes: implications for individualized therapeutics. *Chin J Cancer* 2014; **33**: 469-470 [PMID: 25223913 DOI: 10.5732/cjc.014.10117]
- 4 Cristescu R, Lee J, Nebozhyn M, Kim KM, Ting JC, Wong SS, Liu J, Yue YG, Wang J, Yu K, Ye XS, Do IG, Liu S, Gong L, Fu J, Jin JG, Choi MG, Sohn TS, Lee JH, Bae JM, Kim ST, Park SH, Sohn I, Jung SH, Tan P, Chen R, Hardwick J, Kang WK, Ayers M, Hongyue D, Reinhard C, Loboda A, Kim S, Aggarwal A. Molecular analysis of gastric cancer identifies subtypes associated with distinct clinical outcomes. *Nat Med* 2015; **21**: 449-456 [PMID: 25894828 DOI: 10.1038/nm.3850]
- 5 Katai H, Ishikawa T, Akazawa K, Isobe Y, Miyashiro I, Oda I, Tsujitani S, Ono H, Tanabe S, Fukagawa T, Nunobe S, Kakeji Y, Nashimoto A; Registration Committee of the Japanese Gastric Cancer Association. Five-year survival analysis of surgically resected gastric cancer cases in Japan: a retrospective analysis of more than 100,000 patients from the nationwide registry of the Japanese Gastric Cancer Association (2001-2007). *Gastric Cancer* 2018; **21**: 144-154 [PMID: 28417260 DOI: 10.1007/s10120-017-0716-7]
- 6 Zhao Y, Wang X, Huang Y, Zhou X, Zhang D. Conversion of immunohistochemical markers and breast density are associated with pathological response and prognosis in very young breast cancer patients who fail to achieve a pathological complete response after neoadjuvant chemotherapy. *Cancer Manag Res* 2019; **11**: 5677-5690 [PMID: 31417311 DOI: 10.2147/CMAR.S198844]
- 7 Kooby DA, Suriawinata A, Klimstra DS, Brennan MF, Karpeh MS. Biologic predictors of survival in node-negative gastric cancer. *Ann Surg* 2003; **237**: 828-35; discussion 835 [PMID: 12796579 DOI: 10.1097/01.Sla.0000072260.77776.39]
- 8 Chen D, Fu M, Chi L, Lin L, Cheng J, Xue W, Long C, Jiang W, Dong X, Sui J, Lin D, Lu J, Zhuo S, Liu S, Li G, Chen G, Yan J. Prognostic and predictive value of a pathomics signature in gastric cancer. *Nat Commun* 2022; **13**: 6903 [PMID: 36371443 DOI: 10.1038/s41467-022-34703-w]
- 9 Huang Q, Fang C, Shi J, Sun Q, Wu H, Gold JS, Weber HC, Guan W, Zhang Y, Yu C, Zou X, Mashimo H. Differences in Clinicopathology of Early Gastric Carcinoma between Proximal and Distal Location in 438 Chinese Patients. *Sci Rep* 2015; **5**: 13439 [PMID: 26310451 DOI: 10.1038/srep13439]
- 10 Skancke M, Arnott SM, Amdur RL, Siegel RS, Obias VJ, Umapathi BA. Lymphovascular Invasion and Perineural Invasion Negatively Impact Overall Survival for Stage II Adenocarcinoma of the Colon. *Dis Colon Rectum* 2019; **62**: 181-188 [PMID: 30640833 DOI: 10.1097/DCR.0000000000001258]
- 11 del Casar JM, Corte MD, Alvarez A, García I, Bongera M, González LO, García-Muñiz JL, Allende MT, Astudillo A, Vizoso FJ. Lymphatic and/or blood vessel invasion in gastric cancer: relationship with clinicopathological parameters, biological factors and prognostic significance. *J Cancer Res Clin Oncol* 2008; **134**: 153-161 [PMID: 17628829 DOI: 10.1007/s00432-007-0264-3]
- 12 Hyung WJ, Lee JH, Choi SH, Min JS, Noh SH. Prognostic impact of lymphatic and/or blood vessel invasion in patients with node-negative advanced gastric cancer. *Ann Surg Oncol* 2002; **9**: 562-567 [PMID: 12095972 DOI: 10.1007/bf02573892]
- 13 Torre LA, Bray F, Siegel RL, Ferlay J, Lortet-Tieulent J, Jemal A. Global cancer statistics, 2012. *CA Cancer J Clin* 2015; **65**: 87-108 [PMID: 25651787 DOI: 10.3322/caac.21262]
- 14 Camorlinga-Ponce M, Flores-Luna L, Lazcano-Ponce E, Herrero R, Bernal-Sahagún F, Abdo-Francis JM, Aguirre-García J, Muñoz N, Torres J. Age and severity of mucosal lesions influence the performance of serologic markers in Helicobacter pylori-associated gastroduodenal pathologies. *Cancer Epidemiol Biomarkers Prev* 2008; **17**: 2498-2504 [PMID: 18768521 DOI: 10.1158/1055-9965.EPI-08-0289]
- 15 Song H, Ekhedden IG, Zheng Z, Ericsson J, Nyrén O, Ye W. Incidence of gastric cancer among patients with gastric precancerous lesions: observational cohort study in a low risk Western population. *BMJ* 2015; **351**: h3867 [PMID: 26215280 DOI: 10.1136/bmj.h3867]
- 16 González CA, Pera G, Agudo A, Palli D, Krogh V, Vineis P, Tumino R, Panico S, Berglund G, Simán H, Nyrén O, Agren A, Martinez C, Dorronsoro M, Barricarte A, Tormo MJ, Quiros JR, Allen N, Bingham S, Day N, Miller A, Nagel G, Boeing H, Overvad K, Tjønneland A, Bueno-De-Mesquita HB, Boshuizen HC, Peeters P, Numans M, Clavel-Chapelon F, Helen I, Agapitos E, Lund E, Fahey M, Saracci R, Kaaks R, Riboli E. Smoking and the risk of gastric cancer in the European Prospective Investigation Into Cancer and Nutrition (EPIC). *Int J Cancer* 2003; **107**: 629-634 [PMID: 14520702 DOI: 10.1002/ijc.11426]

- 17 **Hansford S**, Kaurah P, Li-Chang H, Woo M, Senz J, Pinheiro H, Schrader KA, Schaeffer DF, Shumansky K, Zogopoulos G, Santos TA, Claro I, Carvalho J, Nielsen C, Padilla S, Lum A, Talhouk A, Baker-Lange K, Richardson S, Lewis I, Lindor NM, Pennell E, MacMillan A, Fernandez B, Keller G, Lynch H, Shah SP, Guilford P, Gallinger S, Corso G, Roviello F, Caldas C, Oliveira C, Pharoah PD, Huntsman DG. Hereditary Diffuse Gastric Cancer Syndrome: CDH1 Mutations and Beyond. *JAMA Oncol* 2015; **1**: 23-32 [PMID: [26182300](#) DOI: [10.1001/jamaoncol.2014.168](#)]
- 18 **Zhao L**, Han W, Niu P, Lu Y, Zhang F, Jiao F, Zhou X, Wang W, Luan X, He M, Guan Q, Li Y, Nie Y, Wu K, Zhao D, Chen Y. Using nomogram, decision tree, and deep learning models to predict lymph node metastasis in patients with early gastric cancer: a multi-cohort study. *Am J Cancer Res* 2023; **13**: 204-215 [PMID: [36777507](#)]
- 19 **Ajani JA**, D'Amico TA, Bentrem DJ, Chao J, Cooke D, Corvera C, Das P, Enzinger PC, Enzler T, Fanta P, Farjah F, Gerdes H, Gibson MK, Hochwald S, Hofstetter WL, Ilson DH, Keswani RN, Kim S, Kleinberg LR, Klempner SJ, Lacy J, Ly QP, Matkowskyj KA, McNamara M, Mulcahy MF, Outlaw D, Park H, Perry KA, Pimiento J, Poultsides GA, Reznik S, Roses RE, Strong VE, Su S, Wang HL, Wiesner G, Willett CG, Yakoub D, Yoon H, McMillian N, Pluchino LA. Gastric Cancer, Version 2.2022, NCCN Clinical Practice Guidelines in Oncology. *J Natl Compr Canc Netw* 2022; **20**: 167-192 [PMID: [35130500](#) DOI: [10.6004/jnccn.2022.0008](#)]
- 20 **Yoshida K**, Kodera Y, Kochi M, Ichikawa W, Kakeji Y, Sano T, Nagao N, Takahashi M, Takagane A, Watanabe T, Kaji M, Okitsu H, Nomura T, Matsui T, Yoshikawa T, Matsuyama J, Yamada M, Ito S, Takeuchi M, Fujii M. Addition of Docetaxel to Oral Fluoropyrimidine Improves Efficacy in Patients With Stage III Gastric Cancer: Interim Analysis of JACCRO GC-07, a Randomized Controlled Trial. *J Clin Oncol* 2019; **37**: 1296-1304 [PMID: [30925125](#) DOI: [10.1200/JCO.18.01138](#)]
- 21 **Joshi SS**, Badgwell BD. Current treatment and recent progress in gastric cancer. *CA Cancer J Clin* 2021; **71**: 264-279 [PMID: [33592120](#) DOI: [10.3322/caac.21657](#)]
- 22 **Wang FH**, Zhang XT, Li YF, Tang L, Qu XJ, Ying JE, Zhang J, Sun LY, Lin RB, Qiu H, Wang C, Qiu MZ, Cai MY, Wu Q, Liu H, Guan WL, Zhou AP, Zhang YJ, Liu TS, Bi F, Yuan XL, Rao SX, Xin Y, Sheng WQ, Xu HM, Li GX, Ji JF, Zhou ZW, Liang H, Zhang YQ, Jin J, Shen L, Li J, Xu RH. The Chinese Society of Clinical Oncology (CSCO): Clinical guidelines for the diagnosis and treatment of gastric cancer, 2021. *Cancer Commun (Lond)* 2021; **41**: 747-795 [PMID: [34197702](#) DOI: [10.1002/cac2.12193](#)]
- 23 **Lee J**, Lim DH, Kim S, Park SH, Park JO, Park YS, Lim HY, Choi MG, Sohn TS, Noh JH, Bae JM, Ahn YC, Sohn I, Jung SH, Park CK, Kim KM, Kang WK. Phase III trial comparing capecitabine plus cisplatin versus capecitabine plus cisplatin with concurrent capecitabine radiotherapy in completely resected gastric cancer with D2 lymph node dissection: the ARTIST trial. *J Clin Oncol* 2012; **30**: 268-273 [PMID: [22184384](#) DOI: [10.1200/JCO.2011.39.1953](#)]
- 24 **Noh SH**, Park SR, Yang HK, Chung HC, Chung IJ, Kim SW, Kim HH, Choi JH, Kim HK, Yu W, Lee JI, Shin DB, Ji J, Chen JS, Lim Y, Ha S, Bang YJ; CLASSIC trial investigators. Adjuvant capecitabine plus oxaliplatin for gastric cancer after D2 gastrectomy (CLASSIC): 5-year follow-up of an open-label, randomised phase 3 trial. *Lancet Oncol* 2014; **15**: 1389-1396 [PMID: [25439693](#) DOI: [10.1016/S1470-2045\(14\)70473-5](#)]
- 25 **Zhu XD**, Huang MZ, Wang YS, Feng WJ, Chen ZY, He YF, Zhang XW, Liu X, Wang CC, Zhang W, Ying JE, Wu J, Yang L, Qin YR, Luo JF, Zhao XY, Li WH, Zhang Z, Qiu LX, Geng QR, Zou JL, Zhang JY, Zheng H, Song XF, Wu SS, Zhang CY, Gong Z, Liu QQ, Wang XF, Xu Q, Wang Q, Ji JM, Zhao J, Guo WJ. XELOX doublet regimen versus EOX triplet regimen as first-line treatment for advanced gastric cancer: An open-labeled, multicenter, randomized, prospective phase III trial (EXELOX). *Cancer Commun (Lond)* 2022; **42**: 314-326 [PMID: [35212487](#) DOI: [10.1002/cac2.12278](#)]



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