Efficacy and safety of traditional Chinese medicine nursing intervention in postoperative patients after gastrectomy

LIZHI FAN[1], YING HE[2], YUFENG LI[3], XINXIN LI[4], DAN LIU[5] and RUI WANG[5]

[1]Cadre Ward (Geriatric), The First Hospital of Harbin, Harbin, Heilongjiang 150000; Departments of [2]Ultrasonography and [3]Thoracic Surgery, Hongqi Hospital Affiliated to Mudanjiang Medical College, Mudanjiang, Heilongjiang 157000; [4]Intensive Care Unit, First Affiliated Hospital of Harbin Medical University, Harbin, Heilongjiang 150000; [5]Department of General Surgery, Hongqi Hospital Affiliated to Mudanjiang Medical College, Mudanjiang, Heilongjiang 157000, P.R. China

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Abstract. Gastrectomy is a technically demanding procedure for gastric cancer patients that is associated with different degrees of postoperative complications (POCs). Perioperative traditional Chinese medicine (TCM) nursing intervention presents benefits for improving the survival of patients with gastric cancer. However, the effects of TCM nursing intervention on POCs and the prognosis of patients with gastric cancer following surgery are far from clear. In the present study, the effects of TCM nursing intervention on POCs, postoperative physical capacity, metal status, long-term survival and recurrence were investigated in patients with gastric cancer after gastrectomy. In total, 1,032 patients with gastric cancer were included in the study. The patients underwent a gastrectomy and were randomly divided into two groups: The TCM nursing intervention group (TCM group; n=520) and the routine nursing intervention group (control group; n=512). Postoperative pain score, hospital stay, POCs, postoperative gastrointestinal function, frequency of postoperative symptoms, inflammatory index, quality of life, physical capacity, mental status, survival and recurrence were compared after gastrectomy in the TCM and control groups. The treatment-related adverse events of TCM in patients after gastrectomy were recorded in the TCM nursing intervention group. The outcomes showed that TCM nursing intervention decreased the postoperative pain score and hospital stay, improved gastrointestinal function, and decreased the POCs and the inflammation index compared with the control group. In addition, TCM nursing intervention improved physical capacity, quality of life, depression, anxiety, immune activity, long-term survival and recurrence in patients with gastric cancer after gastrectomy. Furthermore, TCM nursing intervention was only associated with a low number of adverse events. In conclusion, outcomes in this study indicate that perioperative TCM nursing intervention improves POCs, mental status, long-term survival and reduces the recurrence of patients with gastric cancer, suggesting that TCM nursing intervention is efficacious and safe with regard to improving the prognosis in these patients after gastrectomy (Retrospective clinical trial registration number, 2015001CW1; name of the register, The First Hospital of Harbin; date of registration, May 7, 2015).

Correspondence to: Professor Rui Wang, Department of General Surgery, Hongqi Hospital Affiliated to Mudanjiang Medical College, 5 Tongxiang Road, Mudanjiang, Heilongjiang 157000, P.R. China
E-mail: lizhifanhrb@163.com

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Introduction

Gastric cancer is one of the leading causes of cancer death and a malignant tumor with a high global incidence (11.7%) (1). Gastric cancer is also a common gastrointestinal tumor, and the 5-year survival rate is very low (<15.0%) (2). In China, gastric cancer has a rapid annual increase in incidence, and was responsible for 8.2% of all deaths from cancer in 2018 (3-5). Clinically, gastrectomy is the main treatment for patients with non-metastatic gastric cancer, and early surgery can reduce the incidence of cancer-related mortality and tumor metastasis (6,7). Although the prognosis of advanced gastric cancer has been improved by the use of gastrectomy with adjuvant therapy (radiotherapy, chemotherapy, immunotherapy and other therapies), the 5-year overall survival rate is still low (8). In addition, patients with gastric cancer who undergo gastrectomy frequently experience postoperative complications (POCs), with a reported range of 20-46% of cases affected (9). The most common POCs of patients with gastric cancer who undergo gastrectomy are gastric hemorrhage, duodenal stump rupture, gastrointestinal anastomotic fistula and postoperative obstruction (10). Furthermore, POCs may increase the risk of metal health issues and decrease the quality of life in the perioperative period (11).

Traditional Chinese medicine (TCM) has antitumor potential, with the characteristics of access to multiple targets, a low number of side effects and good therapeutic effects (12). TCM nursing intervention is frequently used in clinical care, including for postoperative care for malignant tumor resections and percutaneous coronary intervention (13). In recent

years, TCM has been shown to be effective in treating patients with gastric cancer, with its main advantages being that it is a comprehensive intervention with multiple approaches and multiple targets for tumor cells (14-16). Clinically, TCM nursing can prolong the survival time and improve the quality of life for patients with cancer due to less side effects (17). Perioperative TCM nursing intervention can improve an unhealthy mental state and reduces the occurrence of POCs in patients with gastric cancer (18). Treatment with TCM regulates both innate immunity (dendritic cells, myeloid-derived suppressor cells, natural killer cells and macrophages) and adaptive immunity (regulatory T and B cells, and CD4/CD8 T lymphocytes) (19). Combining early chemotherapy with TCM (Zhipu Liujunzi decoction) nursing intervention can improve the function of the immune system and the quality of life in patients with gastric cancer after surgery (20). More recently, the understanding of the targets and mechanisms of TCM involved in the consequent alterations in tumor parameters has expanded (16,21). Notably, when used as an adjuvant therapy TCM has been indicated to extend the median survival time and improve the overall survival rate of patients with gastric cancer (22). However, further studies and clinical trials are required in order to assess the efficiency and safety of TCM in patients with gastric cancer after gastrectomy.

Nursing intervention is an effective approach to aid patients with gastric cancer who suffer from psychological disorders during the perioperative period (23). Although postoperative TCM nursing interventional therapy should be integrated for patients across all stages of gastric cancer, most nursing intervention has focused on patients with metastatic disease (24). It has been shown that Jianpi Yangzheng Xiaozheng decoction can reduce the incidence of adverse drug reactions and improve the quality of life of patients with gastric cancer (25). Jianpi Yangzheng Xiaozheng decoction comprises Dangshen (Campanulaceae), Baizhu (Composite), Fuling (Polyporaceae), Shengyiren (Composite), Danggui (Grass family), Shanyao (Dioscoreaceae), Muxiang (Composite), Baishao (Asclepiadaceae), Chenpi (Rutaceae), Baqia (Liliaceae), Shijianchuan (Lamiaceae) and Zhigancao (Leguminosae), which decrease the toxic effects of chemotherapy, regulate immune function and improve macrophage cell activity in patients with gastric cancer (26). Jianpi Yangzheng Xiaozheng decoction considerably improves the quality of life of patients, relieving pain and prolonging survival time for patients with advanced-stage gastric cancer in China (25). However, there is limited knowledge on the potential effects of Jianpi Yangzheng Xiaozheng decoction nursing intervention on patients with gastric cancer after gastrectomy.

The present study investigated the ameliorative effects of TCM (Jianpi Yangzheng Xiaozheng decoction) nursing intervention on POCs and long-term survival in patients with gastric cancer after curative resection. The effects of TCM nursing intervention on postoperative gastrointestinal function, inflammatory index, physical capacity, quality of life, immune activity and recurrence were also systematically investigated.

Materials and methods

Patients. The present study is a prospective, randomized controlled trial that was performed in The First Hospital of Harbin (Harbin, China). The study protocol was approved by the Ethics Committee of The First Hospital of Harbin (approval no. 20150507TFHX1). A total of 1,032 eligible patients with gastric cancer who underwent gastrectomy were recruited between May 2015 and June 2017. All patients were diagnosed with gastric cancer using imaging and pathology assessments and met the indications for radical gastrectomy. The baseline clinicopathological characteristics, including hypoproteinemia, tumor size, tumor stage and American Society of Anesthesiologists grade (27) were analyzed and are shown in Table I. After gastrectomy, patients voluntarily chose to undergo postoperative treatment and all patients provided written informed consent. All the patients were randomly assigned into two groups: The TCM nursing intervention group (TCM group; n=520) and the routine nursing intervention group (control group; n=512). Patients were assigned into these two groups using a block randomization method based on the disease status of patients with cancer (28). No differences in treatment were applied between the two groups, with the exception of the Jianpi Yangzheng decoction. The TCM used in this study was Jianpi Yangzheng decoction, which is composed of 12 types of Chinese herbal medicine (15 g Dangshen, 10 g Baizhu, 10 g Fuling, 15 g Shengyiren, 10 g Danggui, 15 g Shanyao, 10 g Muxiang, 10 g Baishao, 6 g Chenpi, 10 g Baqia, 15 g Shijianchuan and 3 g Zhigancao) (26). The raw herbs for the Jianpi Yangzheng decoction were obtained from Heilongjiang Traditional Chinese Medicine Hospital (Harbin, China). All the herbs were mixed with 500 ml sterile water and boiled for 30 min, and then the patients drunk the leachate. One dose of Jianpi Yangzheng decoction was orally administrated to the TCM group every day after gastrectomy for at least 6 months. The study flowchart is shown in Fig. 1. The duration of the postoperative hospital stay for patients after gastrectomy was recorded.

Inclusion criteria and exclusion criteria. The inclusion criteria for the study were as follows: i) Patients diagnosed with gastric cancer; ii) patients aged from 25 to 70 years old; iii) patients with a life expectancy of at least 6 months; iv) patients underwent a gastrectomy; v) after gastrectomy, patients provided written informed consent to participate in the study according to the Good Clinical Practice criteria (29); and vi) a Karnofsky Performance Status score of >60 (30). The exclusion criteria were as follows: i) Patients with other cancer types; ii) pregnant or lactating women; iii) patients who were unable to swallow TCM; iv) patients with symptomatic brain metastasis or mental disorders; and v) patients with severe cardiovascular disease, chronic liver disease, kidney disease or blood disease.

Physical capacity. To assess physical capacity, the 6-min walk test (6-MWT) (31) was performed every 2 months in the patients of each group. The test was performed in a 50-meter corridor and all patients were instructed to walk as far as possible in 6 min.

Postoperative pain and POCs. After gastrectomy, the postoperative pain scores of the patients in the two groups were evaluated every 3 days during the hospital stay (on days 0, 3, 6, 9, 12 and 15) using the 0-10 Numeric Rating Scale, with 0

Table I. Baseline clinicopathological characters of patients with gastric cancer who underwent a gastrectomy.

Characteristic	Control	TCM	P-value
Total patients, n (%)	512 (49.6)	520 (50.4)	
Sex, n (%)			0.84[a]
Male	265 (51.8)	272 (52.3)	
Female	247 (48.2)	248 (47.7)	
Age, years	57.2±7.3	57.8±8.2	0.72[b]
BMI, kg/m^2	22.4±3.6	22.2±3.4	0.78[b]
Hypoproteinemia, n (%)			0.72[a]
Yes	412 (80.5)	408 (78.5)	
No	100 (19.5)	112 (21.5)	
Tumor size, n (%)			0.80[a]
≤5 cm	391 (76.4)	397 (76.3)	
>5 cm	121 (23.6)	123 (23.7)	
TNM tumor stage, n (%)			0.90[a]
I	138 (27.0)	142 (27.3)	
II	313 (61.1)	320 (61.5)	
III	61 (11.9)	58 (11.2)	
ASA grade, n (%)			0.87[a]
I	330 (64.5)	336 (64.6)	
II	120 (23.4)	115 (22.1)	
III	62 (12.1)	69 (13.3)	

Data are shown as mean ± standard deviation unless otherwise specified. [a]Pearson's χ^2 test or [b]Student's t-test was used to compare the data between the two groups. BMI, body mass index; ASA, American Society of Anesthesiologists; CCI, Charlson Comorbidity Index; TNM, Tumor-Node-Metastasis; TCM, traditional Chinese medicine.

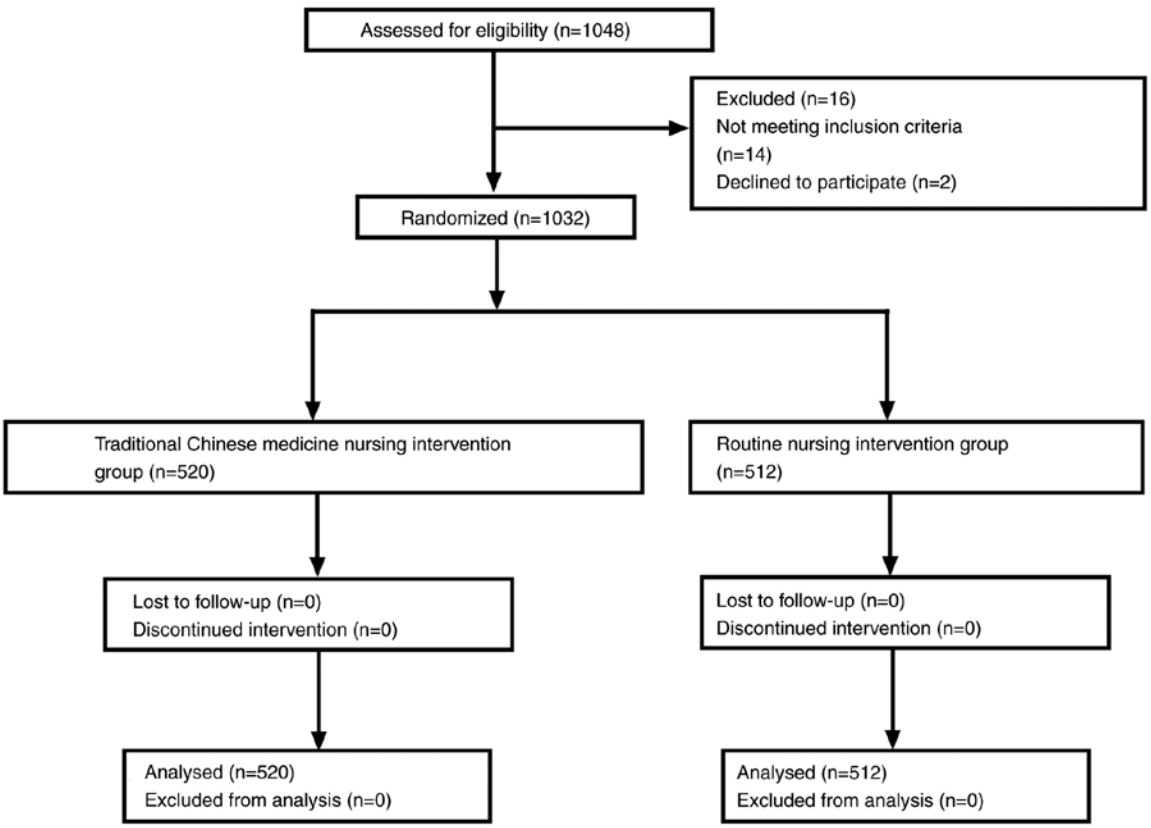

Figure 1. Flow diagram of the study.

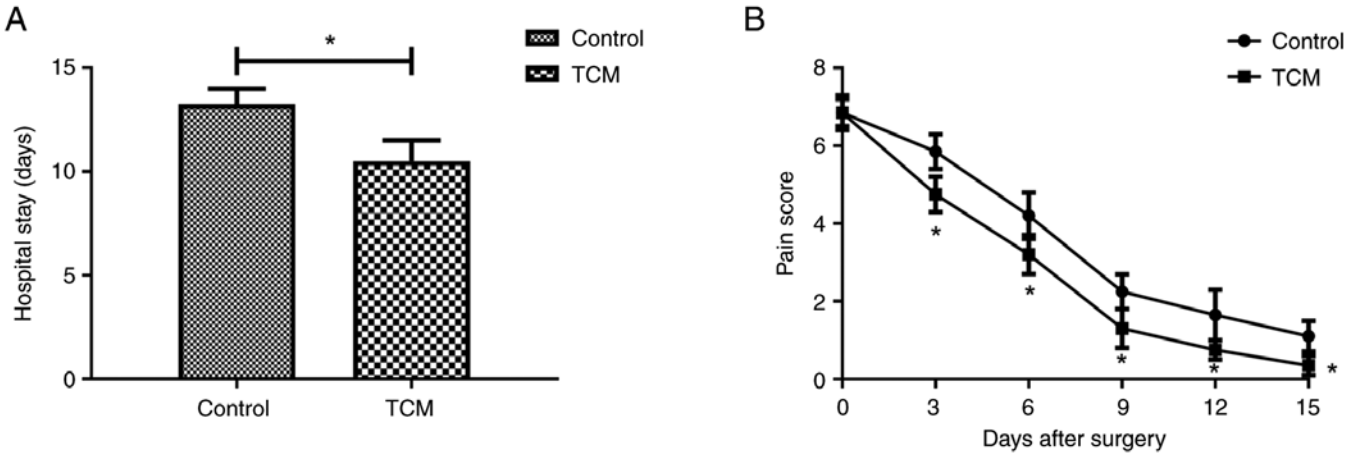

Figure 2. Effects of TCM nursing intervention on hospital stay and postoperative pain in patients with gastric cancer who underwent surgery. (A) Duration of hospital stay after surgery in the TCM nursing intervention and routine nursing intervention (control) groups. (B) Postoperative pain score after surgery in the TCM nursing intervention and routine nursing intervention (control) groups. *P<0.05 vs. control. TCM, traditional Chinese medicine.

representing no pain and 10 representing the worst imaginable pain (32). POCs in the patients with gastric cancer after surgery were recorded and classified according to the Clavien-Dindo (C-D) classification grade (33).

Postoperative inflammation. Blood samples were collected from each patient every 3 days (on days 0, 3, 6, 9, 12 and 15) to measure serum inflammatory cytokine levels. Postoperative inflammation score was determined by inflammation score, as described previously (34). Postoperative serum levels of C-reactive protein (CRP) (cat. no. ab260058), IL-1β (cat. no. ab214025), IL-6 (cat. no. ab178013), IL-8 (cat. no. ab214030), IL-10 (cat. no. ab185986) and TNF-α (cat. no. ab181421) were measured using ELISA kits (all Abcam) according to the manufacturer's instructions. $CD3^+$, $CD4^+$, $CD8^+$, $CD16^+$, $CD19^+$ and $CD45^+$ expression levels in peripheral T lymphocytes were analyzed using a FACS Canto II flow cytometer and FACS Diva software (BD Biosciences).

Analysis of gastrointestinal function, abdominal pain and abdominal distention. The clinical outcomes were standard measures of gastrointestinal function and included the time from the operation to the first passage of flatus, the time from the operation to the passage of the first defecation, and the number of patients who were comfortable with the intake of a semi-fluid diet as measured every 3 days (on days 0, 3, 6, 9, 12 and 15 days) during the hospitalization. The abdominal pain of each patient from the two groups was evaluated using Prince Henry Pain Scale scoring (35) (0, no pain when coughing; 1, pain only when coughing; 2, no pain when quiet, but pain with deep breathing; 3, mild and bearable pain when resting; 4, severe and unbearable pain). Abdominal distension (36) was evaluated using the following scale: 0, no sense of abdominal distension; 1, mild distension; 2, moderate abdominal distention; and 3, severe abdominal distention.

Postoperative metal status. Postoperative mental status was evaluated in patients every 2 months post-surgery by clinicians for a total of 12 months. Quality of life after surgery was evaluated using the 36-Item Short Form Health Survey (SF-36) questionnaire (37). Scores in the SF-36 range from 0 to 100 (0 representing the worst and 100 the best). The Beck Depression Inventory (38) was used to assess the depression level in the patients after surgery. The Beck Depression Inventory includes 21 clinical symptoms of depression and the scores range from 5 to 63 (5-9, normal; 10-18, mild-to-moderate depression; 19-29, moderate-to-severe depression; 30-63, severe depression). Anxiety in patients with gastric cancer after surgery was determined by the State-Trait Anxiety Inventory (STAI) (39). The STAI includes separate measures of state- and trait-anxiety, which are scored as a minimum of 20 to a maximum of 80 (20-29, without anxiety; 20-30, the presence of anxiety; 31-49, an intermediate level of anxiety; 50-80, a high degree of anxiety).

Postoperative survival, recurrence and follow-up. Patients were followed up every 3 months during the 60-month follow up period. The overall survival time of the patients with gastric cancer after surgery was recorded from the date of surgery to death or the last follow-up. Recurrence time was defined as the time from surgery to recurrence or the last follow-up.

Safety of TCM. The safety of the TCM used in this study was assessed using National Cancer Institute Common Terminology Criteria for Adverse Events, version 4.0 (40).

Statistical analysis. Data are expressed as the mean ± standard deviation or n (%). Data were analyzed using SPSS version 21.0 (SPSS Inc.; IBM Corp.). Unpaired Student's t-test was used to compare the data between two groups. Qualitative data were calculated using the χ^2 test or Fisher's test. Overall survival and recurrence were analyzed using Kaplan-Meier analysis. P<0.05 was considered to indicate a statistically significant difference.

Results

Characteristic of patients with gastric cancer. A total of 1,032 patients with gastric cancer who underwent a gastrectomy were recruited to the present study. Patients with a mean

Table II. Effect of TCM nursing intervention on hospital stay, postoperative pain and frequency of postoperative symptoms.

Events	Control	TCM	P-value
Hospital stay, days	12.5±3.5	10.5±2.5	0.046[a]
Postoperative pain score	6.4±1.8	5.3±1.3	0.040[a]
Use rate of opioids, %	63.6±7.5	45.2±6.8	0.025[a]
Postoperative symptoms, n (%)			
Dizziness	42 (8.2)	25 (4.8)	0.032[b]
Vomiting	25 (4.9)	16 (3.1)	0.044[b]
Nausea	30 (5.9)	18 (3.5)	0.040[b]
Distention	36 (7.0)	22 (4.2)	0.018[b]
Diarrhea	41 (8.0)	30 (5.8)	0.032[b]
Comfort of intake of a semi-fluid diet	417 (81.4)	476 (91.5)	0.012[b]
C-D grade, n (%)			
I	368 (71.9)	403 (77.5)	0.032[b]
II	42 (8.2)	67 (12.9)	0.035[b]
III	25 (4.9)	14 (2.7)	0.041[b]
IV	23 (4.5)	12 (2.3)	0.020[b]
V	19 (3.7)	9 (1.7)	0.044[b]
VI	15 (2.9)	7 (1.3)	0.041[b]
VII	10 (2.0)	5 (1.0)	0.028[b]
VIII	10 (2.0)	3 (0.6)	0.013[b]

Data are shown as the mean ± standard deviation unless otherwise specified. Comparisons between groups were conducted using the [a]Pearson's χ^2 test or [b]Student's t-test for categorical and continuous variables, respectively. TCM, traditional Chinese medicine; C-D, Clavien-Dindo.

age of 57.5 years (range, 53.2-62.8 years) were assigned into two groups: The TCM group (n=520) and the control group (n=512). There were 560 male and 472 female patients with gastric cancer. The surgical outcomes of the patients are shown in Table I. All patients received the same anesthetic drugs during the operation and underwent a gastrectomy. There were no significant differences between the two groups (all P>0.05). The study follow-up time was 60 months.

Effects of TCM nursing intervention on hospital stay, postoperative pain and frequency of postoperative symptoms. To verify the efficacy of TCM nursing intervention, hospital stay, postoperative pain and frequency of postoperative symptoms in patients were evaluated between the two groups. Patients in the TCM nursing intervention group had a shorter hospital stay and lower postoperative pain scores compared with those in the control group (both P<0.05; Fig. 2). It was observed that TCM nursing intervention decreased the use rate of opioids compared with the control group (P<0.05; Table II). Compared with the control, TCM nursing intervention significantly decreased the frequency of postoperative dizziness, vomiting, nausea, distention, diarrhea and comfort of intake of a semi-fluid diet during the hospital stay (all P<0.05; Table II).

Effects of TCM nursing intervention on postoperative gastrointestinal dysfunction. Postoperative gastrointestinal dysfunction can cause the accumulation of secretions and gas, which will result in postoperative symptoms of gastrointestinal discomfort after gastrectomy (41). Thus, the differences in postoperative gastrointestinal dysfunction were compared between the two groups of patients with gastric cancer who underwent gastrectomy (Table III). The data revealed that TCM nursing intervention significantly decreased the time to first postoperative flatus and defecation, and the fasting time (all P<0.05). Postoperative patients in the TCM group were more comfortable with the intake of a semi-fluid diet than patients in the control group at 15 days post-surgery. Compared with the control, TCM nursing intervention significantly decreased the occurrence of abdominal pain and abdominal distension in the patients after gastrectomy (all P<0.05; Table III).

Effects of TCM nursing intervention on postoperative inflammation index in gastric cancer patients. The effects of TCM nursing intervention on postoperative inflammation index were analyzed in the patients with gastric cancer who underwent gastrectomy. As shown in Fig. 3A, the patients in the TCM group exhibited lower inflammation scores than those in the control group at 6 days post-surgery. TCM nursing intervention also decreased the inflammatory cytokines levels of CRP, IL-1β, IL-6, TNF-α, IL-8 and IL-10 after gastrectomy compared with the control group during the hospital stay (Fig. 3B-G).

Effects of TCM nursing intervention on POCs in patients with gastric cancer who underwent gastrectomy. POCs in each patient with gastric cancer were recorded, classified according to the C-D classification grade and compared between the two groups. The characteristics of the patients in each C-D grade in

Table III. Effect of TCM nursing intervention on postoperative gastrointestinal dysfunction in gastric cancer patients after surgery.

Events	Control	TCM	P-value
Time to first postoperative flatus, days	3.2±0.8	1.5±0.4	0.033[a]
Time to first postoperative defecation, days	4.0±1.6	2.1±0.8	0.028[a]
Fasting time, days	3.6±1.0	1.4±0.6	0.022[a]
Comfortable with semi-fluid diet, n (%)	432 (84.4)	481 (92.5)	0.010[b]
Duration of postoperative stay, days	9.7±3.8	6.2±2.4	0.029[a]
Postoperative abdominal pain grade, n (%)			
1	186 (36.3)	205 (39.4)	0.045[b]
2	245 (47.9)	285 (54.8)	0.042[b]
3	53 (10.4)	18 (3.5)	0.010[b]
4	28 (5.5)	12 (2.3)	0.027[b]
Postoperative abdominal distension grade, n (%)			
0	95 (18.6)	162 (31.2)	0.008[b]
1	121 (23.6)	146 (28.1)	0.041[b]
2	168 (32.8)	124 (23.8)	0.024[b]
3	128 (25.0)	88 (16.9)	0.026[b]

Data are shown as mean ± standard deviation unless otherwise specified. [a]Pearson's χ^2 test or [b]Student's t-test were used to compare the data between the two groups. TCM, traditional Chinese medicine.

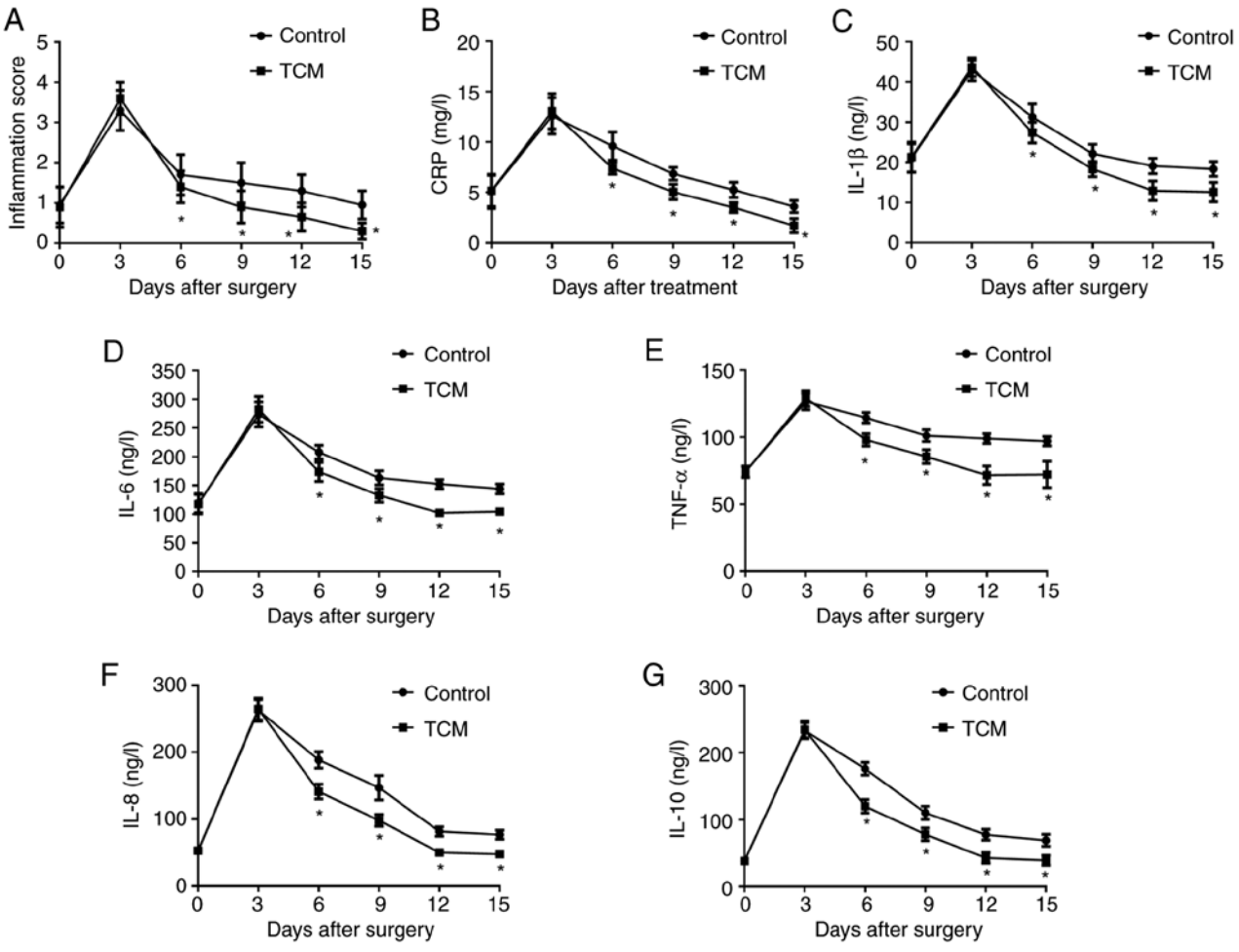

Figure 3. Effects of TCM nursing intervention on inflammation score and postoperative inflammatory cytokine concentrations in patients with gastric cancer who underwent surgery. (A) Inflammation scores in the TCM nursing intervention and routine nursing intervention (control) groups. (B-G) Inflammatory cytokine levels of (B) CRP, (C) IL-1β, (D) IL-6, (E) TNF-α, (F) IL-8 and (G) IL-10 after surgery in the TCM nursing intervention and routine nursing intervention (control) groups. *P<0.05 vs. control. TCM, traditional Chinese medicine; CRP, C-reactive protein.

Table IV. Effect of TCM nursing intervention on postoperative complications in patients with gastric cancer who underwent surgery.

Clavien-Dindo grade	Control, n (%)	TCM, n (%)	P-value
I	368 (71.9)	403 (77.5)	0.031
II	42 (8.2)	67 (12.9)	0.036
III	25 (4.9)	14 (2.7)	0.041
IV	23 (4.5)	12 (2.3)	0.020
V	19 (3.7)	9 (1.7)	0.044
VI	15 (2.9)	7 (1.3)	0.040
VII	10 (2.0)	5 (1.0)	0.030
VIII	10 (2.0)	3 (0.6)	0.015

Student's t-test was used to compare the data between the two groups. TCM, traditional Chinese medicine.

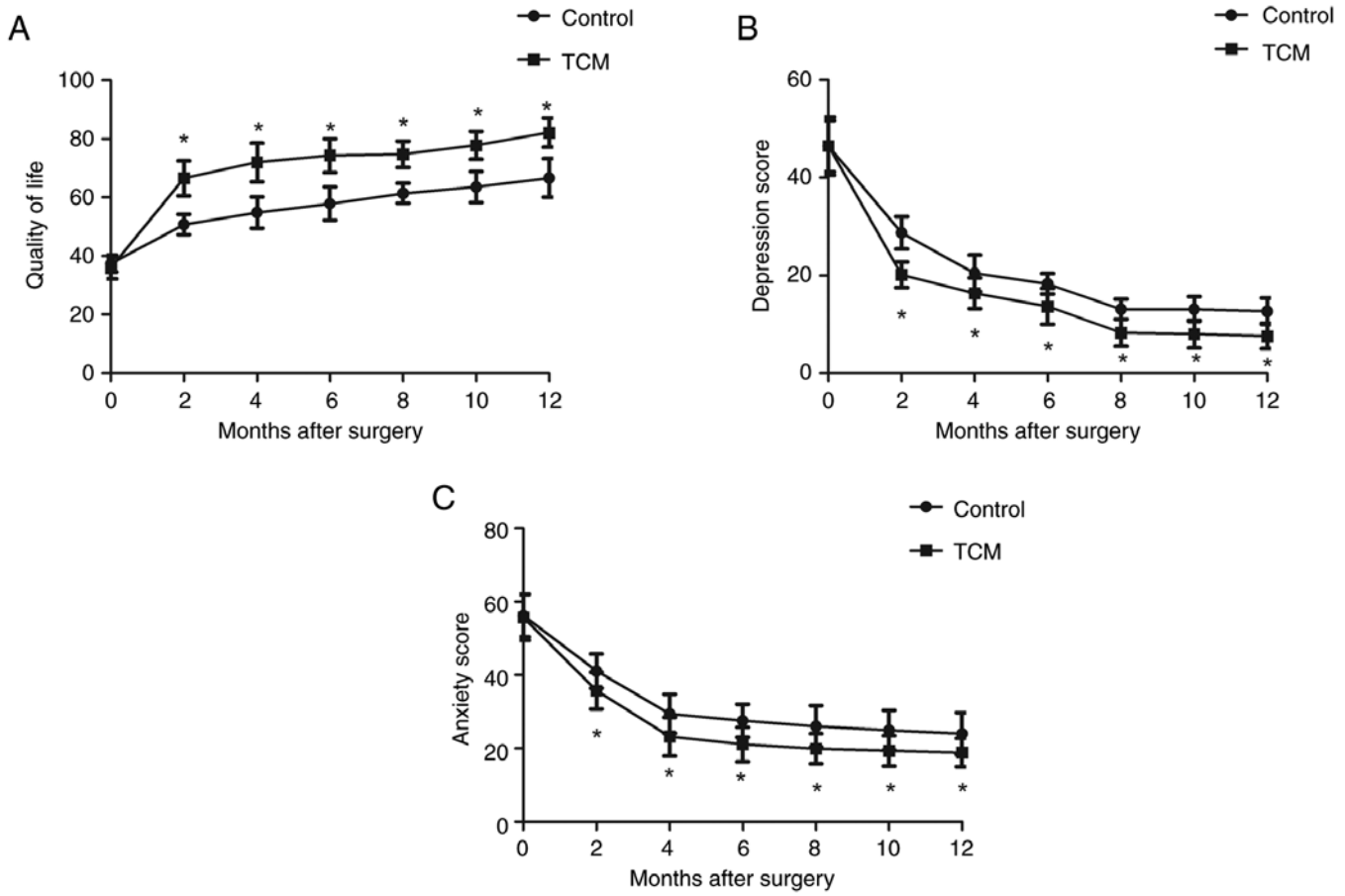

Figure 4. Effects of TCM nursing intervention on mental status in patients with gastric cancer who underwent surgery. (A) Quality of life after surgery was measured using the 36-Item Short Form Health Survey. (B) Depression after surgery was measured using the Beck Depression Inventory. (C) Anxiety after surgery was measured using the State-Trait Anxiety Inventory. Comparisons were made between the TCM nursing intervention and routine nursing intervention (control) groups. *P<0.05 vs. control. TCM, traditional Chinese medicine.

the propensity score-matched cohorts are shown in Table IV. Grade I complications were present in 403 (77.5%) and 368 (71.9%) patients in the TCM and control groups, respectively. Grade II complications were recorded in 67 (13.1%) and 42 (8.1%) patients in the TCM and control groups, respectively. It was also demonstrated that 14 (2.7%) and 25 (4.9%) patients experienced grade III complications in the TCM and control groups, respectively, while patients with grade IV-VIII complications accounted for 36 (6.9%) and 77 (15.0%) patients at 12 months after surgery in the TCM and control groups, respectively.

Effect of TCM nursing intervention on physical capacity and metal status. Physical capacity and metal status were

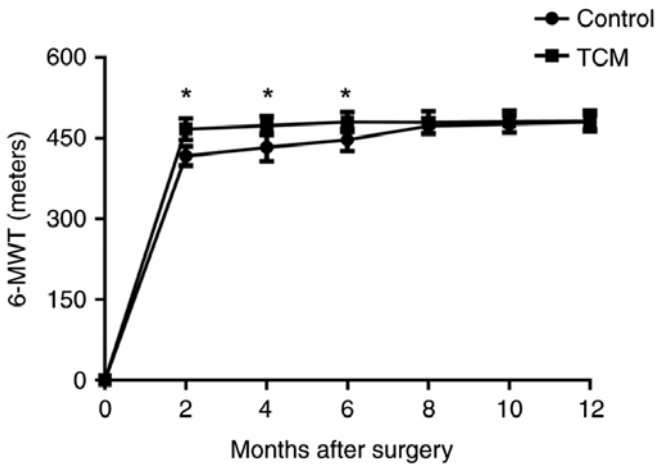

Figure 5. Effects of TCM nursing intervention on postoperative physical capacity in patients with gastric cancer who underwent surgery. Postoperative physical capacity was measured using 6-MWT after surgery in the TCM nursing intervention and routine nursing intervention (control) groups. *P<0.05 vs. control. TCM, traditional Chinese medicine; 6-MWT, 6-min walk test.

evaluated at the time of hospitalization and discharge for the two groups of patients with gastric cancer who underwent gastrectomy. The results data showed that TCM nursing intervention significantly improved clinician-rated measures of depression and anxiety during hospitalization compared with the control (all P<0.05). The quality of life of the patients after gastrectomy also increased in the TCM nursing intervention group when compared with that of the control group (all P<0.05). After 12-month discharge, the patients in the TCM group experienced less depression and anxiety, and a higher quality of life than those in the control group (all P<0.05) (Fig. 4). TCM nursing intervention also improved the postoperative physical capacity, as determined by 6-MWT (Table V). TCM nursing intervention increased the physical capacity of gastric cancer patients at 2, 4 and 6 months compared with the control (Fig. 5). After 6 months of follow-up, no significant difference in postoperative physical capacity was observed between the two groups.

Effects of TCM nursing intervention on postoperative immune activity. It is now known that altered immune cell expression may be responsible for the low survival and poor prognosis in patients with gastric cancer after surgery (42). Thus, the immune function in patients with gastric cancer who underwent gastrectomy was compared between the two treatment groups in the present study. As shown in Table VI, $CD3^+$, $CD4^+$, $CD8^+$, $CD16^+$, $CD19^+$ and $CD45^+$ expression levels were recorded in peripheral T lymphocytes, and were higher in patients in the TCM group compared with those in the control group (all P<0.05). Compared with that in the control group, a significant increase in the concentration of natural killer cells and T cells was observed in patients in the TCM group (both P<0.05) (Table VI).

Effects of TCM nursing intervention on survival and recurrence. The survival and recurrence times in the

Table V. Effect of TCM nursing intervention on postoperative physical capacity in patients with gastric cancer who underwent surgery.

Day	Control group	TCM group	P-value
3	252.2±86.4	276.0±93.5	0.041
6	275.1±59.7	302.4±68.4	0.038
9	328.4±64.2	395.8±60.0	0.034
12	388.0±69.4	442.2±57.2	0.024
15	401.2±77.5	486.5±63.0	0.016

Data are shown as the mean ± standard deviation. Physical functioning is measured in meters. Pearson's χ^2 test was used to compare the data between the two groups. TCM, traditional Chinese medicine.

Table VI. Effect of TCM nursing intervention on survival and recurrence in patients with gastric cancer who underwent surgery.

Immune cells	Control	TCM	P-value
$CD3^+$	35.68±10.10	50.35±12.62	0.024
$CD4^+$	24.12±8.63	40.24±14.46	0.031
$CD8^+$	14.88±6.74	24.60±9.80	0.015
$CD16^+$	18.41±7.65	25.55±10.22	0.039
$CD19^+$	16.25±6.02	24.32±9.40	0.041
$CD45^+$	20.07±6.89	27.06±9.44	0.018
NK cells	8.58±4.16	12.66±6.07	0.044
T cells	6.66±3.45	11.04±6.88	0.030

Data are shown as the mean ± SD. Pearson's χ^2 test was used to compare the data between the two groups. TCM, traditional Chinese medicine; NK, natural killer.

patients with gastric cancer were recorded and compared between the two groups. The data revealed that TCM nursing intervention prolonged the survival after gastrectomy compared with the control during the 60-month follow-up period (Fig. 6A). Furthermore, the mortality rate of gastric cancer was also decreased in the patients in the TCM nursing intervention group (Fig. 6B). During the 5-year follow-up period, 65 (12.7%) patients in the control group died and 142 (27.7%) patients experienced recurrence or tumor metastasis, while only 30 (5.8%) patients died in the TCM nursing intervention group, and 88 (16.9%) patients experienced recurrence or tumor metastasis (Table VII).

Cancer treatment-related adverse events of TCM nursing intervention in patients with gastric cancer who underwent gastrectomy. The treatment-related adverse events were recorded after gastrectomy in the TCM nursing intervention group. Most of the TCM treatment-related adverse events were grade 1 or 2 according to National Cancer Institute Common Terminology Criteria (Table VIII). The

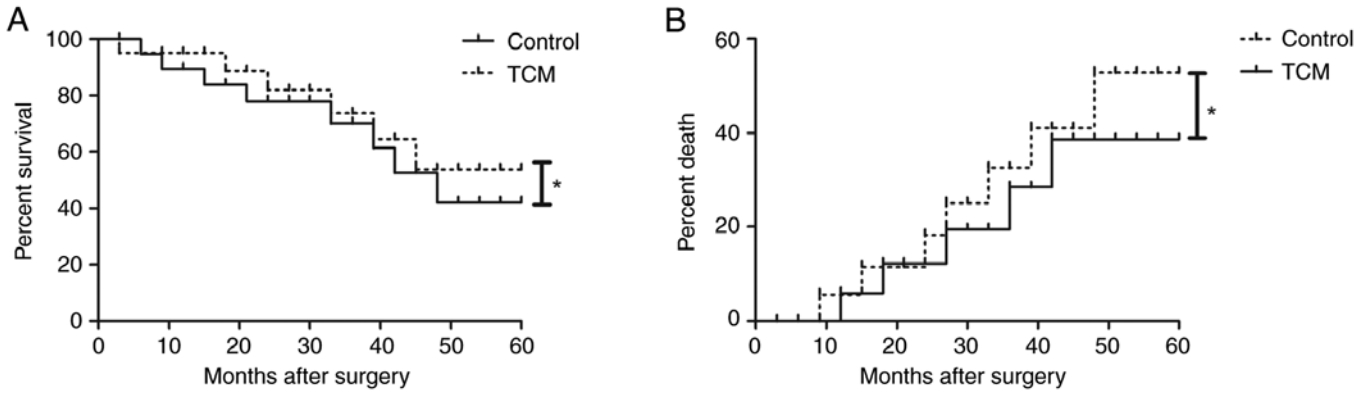

Figure 6. Effect of TCM nursing intervention on survival and recurrence in patients with gastric cancer who underwent surgery. (A) Kaplan-Meier analysis was used to estimate the overall survival after surgery in the TCM nursing intervention and routine nursing intervention (control) groups. (B) Kaplan-Meier analysis was used to estimate the tumor recurrence after surgery in the TCM nursing intervention and routine nursing intervention (control) groups. *P<0.05 vs. control. TCM, traditional Chinese medicine.

Table VII. Effect of TCM nursing intervention on survival and recurrence in patients with gastric cancer who underwent surgery.

Parameter	Control group, n (%)	TCM group, n (%)	P-value
Death	65 (12.7)	30 (5.8)	0.022
Recurrence	142 (27.7)	88 (16.9)	0.011

Student's t-test was used to compare the data between the two groups. TCM, traditional Chinese medicine.

Table VIII. Cancer treatment-related adverse events of traditional Chinese medicine nursing intervention in patients with gastric cancer who underwent surgery.

Treatment-related adverse events	Patients, n (%)
Vomiting	34 (6.5)
Pruritus	48 (9.2)
Gastrointestinal reaction	33 (6.3)
ALT/AST increased	42 (8.1)
Fatigue	28 (5.4)
Hypertension grade	
1	24 (4.6)
2	20 (3.8)
3	12 (2.3)
Diarrhea grade	
1	32 (6.2)
2	30 (5.8)
3	20 (3.8)

ALT, alanine transaminase; AST, aspartate transaminase.

cancer treatment-related adverse events of TCM included vomiting, pruritus, gastrointestinal reaction, increased alanine transaminase (ALT)/aspartate transaminase (AST) levels, fatigue, hypertension and diarrhea. No toxin-induced death was observed in any patient in the TCM nursing intervention group. Of the 55 patients affected, 20 (3.8%) had grade 3 diarrhea, 12 (2.3%) had grade 3 hypertension and 33 (6.3%) had a gastrointestinal reaction, and these patients were forced to reduce the dose of TCM.

Discussion

In general, gastric cancer is the malignant tumor of the digestive tract with the highest incidence, prevalence and mortality rates (43). An increasing number of young individuals are being affected by the condition due to changes in lifestyle and dietary structure in China (44). Despite the treatment strategies that have been applied in patients with gastric cancer, the overall survival rate and prognosis are still poor (45). Clinically, TCM has been proven effective in treating gastric cancer, acting as a comprehensive interventional method that has multiple approaches and targets (14). In addition, TCM nursing intervention can markedly decrease POCs, improve the quality of sleep, relieve postoperative pain, and improve the mental status and quality of life of patients who have received gastric cancer surgery (46). The present study investigated the effects of TCM nursing intervention on POCs, survival and recurrence rate in patients with gastric cancer who underwent gastrectomy. Outcomes showed that TCM nursing intervention significantly improved depression and anxiety, suggesting that postoperative mental state in individuals with gastric cancer may be improved by TMC nursing intervention, with a basis of routine nursing. Results in the current study also pointed out that TCM nursing intervention was extremely effective in decreasing POCs, inflammation and numbers of deaths, and improving the postoperative gastrointestinal dysfunction, physical capacity, quality of life and survival of patients with gastric cancer after gastrectomy.

Most gastric cancer patients need to undergo a gastrectomy, and postoperatively, patients frequently experience gastrointestinal dysfunction, POCs, inflammation and a decreased quality of life (47). A number of studies have

indicated that parameters based solely on preoperative factors are able to identify the patients who are at the greatest risk of a POC. Appropriate postoperative care can then contribute to the improvement of the POC and gastrointestinal dysfunction (48,49). TCM formulae and chemical components isolated from some Chinese herbal medicines have been used to treat gastric cancer, and TCM has been proven effective in treating gastric cancer patients by inhibiting tumor growth (16). In the current study, it was observed that TCM nursing intervention shortened the time until first postoperative flatus, the regression time for epigastric distension symptoms, the time until first defecation and the recovery time until comfortable with semi-solid food for patients with gastric cancer, suggesting that the addition of TCM nursing intervention could improve the gastrointestinal dysfunction after gastrectomy compared with routine nursing. In addition, in another study, perioperative TCM nursing for patients with gastric cancer alleviated acute inflammation and improved the quality of life of 103 patients with gastric cancer (18). Consistent with this, the results in the present study demonstrated that TCM nursing intervention not only improved the quality of life and inflammation index, but also helped the mental status and postoperative physical capacity in the 1,032 patients with gastric cancer who underwent a gastrectomy. Different to other studies, TCM nursing intervention could effectively improve postoperative pain and the frequency of postoperative symptoms. Furthermore, another previous study found that enhanced recovery after gastrectomy could decrease inflammation perioperatively, improve nutrition postoperatively and decrease hospitalization time in patients with gastric carcinoma (50). In the present study, perioperative inflammation and inflammatory cytokines levels of CRP, IL-1β, IL-6, TNF-α, IL-8 and IL-10 in the patients with gastric cancer were significantly lower in the patients in the TCM group compared with those in the patients in the control group during hospitalization.

TCM combined with chemotherapy may extend the overall survival time and increase the survival rate and quality of life of patients with stage IV non-surgical gastric cancer (51). In addition, TCM plays an important role in decreasing inflammation and prolonging survival time in subjects with gastric cancer (52). TCM also has an important potential value for improving the prognosis of patients with advanced gastric cancer (53). The present study evaluated the efficacy of TCM nursing intervention for improving the postoperative POCs of patients after gastrectomy, and also investigated its effect on postoperative survival and prognosis. In a study on oral cancer, the clinical efficacy of TCM anticancer decoctions plus basic chemotherapy and nursing interventions as postoperative treatment was notable, with significant improvements in patient immunity and decreased tumor marker levels (54). Consistent with this, the results of the present study showed that immune activity, quality of life and the 5-year cumulative survival rate of patients in the TCM nursing intervention group were significantly higher than those in the control group. In addition, the recurrence rate for patients in the TCM nursing intervention group was significantly lower than that in the control group. Most patients with gastric cancer who undergo surgery develop recurrence and metastasis (55). In China, almost all patients want to choose aggressive treatment (56), and the present results identified that TCM nursing intervention was effective when compared with the control. Notably, the results showed that a limited number of patients in the TCM nursing intervention group experienced a low number of cancer treatment-related adverse events, such as vomiting, pruritus, gastrointestinal reaction, increased ALT/AST levels, fatigue, hypertension and diarrhea. However, the long-term efficacy of TCM on immune activity, quality of life and 5-year cumulative survival rate in patients with gastric cancer were not analyzed in this study.

In conclusion, TCM nursing intervention has an important value for improving the postoperative gastrointestinal dysfunction, metal status, POCs, inflammation, immune activity, survival, and prognosis of patients with gastric cancer who undergo gastrectomy. In addition, TCM nursing intervention could be effective, safe and well tolerated for patients with gastric cancer who undergo gastrectomy, which suggests its potential clinical application and deserves further research.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

LF and YH conceived and designed the study. YL, XL and DL performed data analysis. RW analyzed the data, and wrote and revised the manuscript. All authors have read and approved the manuscript. LF and RW confirm the authenticity of all the raw data.

Ethics approval and consent to participate

This study was approved by the Ethics Review Committee of The First Hospital of Harbin (Harbin, China; approval no. 20150507TFHX1). Written informed consent was obtained from all subjects.

Patient consent for publication

Written informed consent was obtained from all patients, and all patients agreed to publication of their data.

Competing interests

The authors declare that they have no competing interests.

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