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Body image and quality of life undergoing totally robotic versus robotic-assisted distal gastrectomy: a retrospective propensity score matched cohort study

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Abstract

Background With the improvement of anastomotic techniques and the iteration of anastomotic instruments, robotic intracorporeal suturing has become increasingly proficient. The era of fully intracorporeal anastomosis in robotic gastric cancer resection is emerging. This study aims to explore the impact of totally robotic distal gastrectomy (TRDG) and robotic-assisted distal gastrectomy (RADG) on patients' quality of life.

Patients and methods This study is a comparative retrospective study of propensity score matching. This study included 306 patients who underwent robotic distal gastrectomy for gastric cancer between June 2016 and December 2023 at our center. Covariates used in the propensity score included sex, age, BMI, ASA score, maximum tumour diameter, degree of histological differentiation, Pathological TNM stage, Pathological T stage, Pathological N stage, and Lauren classification. Outcome measures included operative time, intraoperative bleeding, time to first venting, time to first fluid intake, postoperative hospital stay, total hospitalization cost, total length of abdominal incision, postoperative complications, inflammatory response, body image, and quality of life.

Results According to the results of the study, compared with the RADG group, the TRDG group had a faster recovery time for gastrointestinal function ($P=0.025$), shorter length of abdominal incision ($P<0.001$), fewer days in the hospital ($P=0.006$) less pain ($P<0.001$), less need for additional analgesia ($P=0.013$), and a postoperative white blood cell count ($P<0.001$) and C-reactive protein content indexes were lower ($P<0.001$). In addition, the TRDG group had significantly better body imagery and cosmetic scores ($P=0.015$), physical function ($P=0.039$), role function ($P=0.046$), and global function ($P=0.021$) than the RARS group. Meanwhile, the TRDG group had milder symptoms of

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fatigue ($P=0.037$) and pain ($P<0.001$). The PASQ Total Subscale Score ($P<0.001$) and Global Subscale Score ($P<0.001$) were significantly lower in the TRDG group than in the RADG group at postoperative 3 months.

Conclusion Totally robotic distal gastrectomy has a smaller incision, faster gastrointestinal recovery time, fewer days of postoperative hospitalization, and lower inflammatory markers than robotic-assisted distal gastrectomy. At the same time, postoperative cosmetic and quality of life outcomes were satisfactory. Clinically, these benefits translate to enhanced patient recovery, reduced surgical trauma, and better postoperative outcomes. These findings could guide surgeons in selecting more effective surgical approaches for patients undergoing gastrectomy, leading to better overall patient satisfaction and outcomes.

Keywords Totally robotic distal gastrectomy, Robotic-assisted distal gastrectomy, Propensity score matching, Body image, Quality of life

Introduction

Gastric cancer has become a major global health problem due to its high incidence and low survival rate [1]. Radical D2 lymph node dissection is the standard surgical treatment for gastric cancer and is expected to improve long-term patient prognosis [2]. However, this procedure demands a high level of technical skill, limiting the use of minimally invasive techniques in advanced cases. The introduction of the robotic surgical system, with its multi-degree-of-freedom instruments, 3D visualization, and precise manipulation, has addressed many of the limitations of laparoscopy, facilitating more complex surgeries like radical gastrectomy [3].

While the safety and feasibility of robotic radical gastric cancer surgery have been widely validated [4, 5], advancements in intracorporeal anastomosis techniques now enable fully robotic reconstructions without the need for additional abdominal incisions. This approach potentially reduces incision size, minimizes exposure of the abdominal cavity, and supports faster postoperative recovery. However, there is limited research comparing the outcomes of intra-abdominal versus extra-abdominal anastomosis in robotic gastric cancer surgery. This study aims to compare these reconstruction methods, focusing on their impact on patient quality of life and short-term postoperative outcomes, providing new insights and evidence for optimizing robotic radical gastric cancer surgery.

Materials and methods

Patient cohorts

A retrospective analysis of prospectively collected data was conducted at the First Affiliated Hospital of Nanchang University, and it was approved by the institutional review board (IRB) of our center. All procedures were in accordance with the ethical standards of the Center and the requirements of the Declaration of Helsinki. All patients have signed an informed consent form. This study included all patients with resectable gastric cancer without distant metastases diagnosed by imaging and histology at our gastrointestinal surgery center from June 2016 to December 2023 and who underwent robotic radical resection for distal gastric cancer.

Inclusion criteria: (1) postoperative pathological confirmation of distal gastric cancer; (2) no distant metastases were found in preoperative examination and intraoperative; (3) patients without preoperative chemotherapy or radiation therapy.

Exclusion criteria: (1) concomitant combination of other malignant tumors; (2) cases of emergency surgery due to hemorrhage, obstruction, or perforation; (3) patients receiving preoperative radiotherapy; (4) incomplete data or missing follow-up data.

The inclusion and exclusion criteria for both groups were based on the above criteria, and a total of 612 patients were enrolled. 160 patients who underwent fully robotic radical distal gastrectomy were enrolled in the TRDG group, and 452 patients who underwent conventional robot-assisted radical distal gastrectomy were enrolled in the RADG group (Fig. 1).

Surgical technique

All surgeries were performed by the same attending surgeon. In both the TRDG and RADG groups, surgery was performed following the standard robotic distal gastric D2 lymph node dissection + Billroth II style. There was no difference in free dissection of the intra-abdominal omentum, vascular ligation and tumor resection between the two groups. The main difference was the digestive tract reconstruction approach.

The way of digestive tract reconstruction in the TRDG group: residual gastric anastomosis of the jejunum by intraperitoneal linear cutting closure. The surgical procedure was as follows: 10–15 cm of jejunum according to the suspensory ligament of the duodenum was lifted up close to the side of the greater curvature of the residual stomach, and one suture was placed on the left and right side of the proposed anastomosis with absorbable threads for close alignment. An incision of 1–2 cm was made in the greater curvature of the remnant stomach and the jejunum to the mesenteric margin, respectively, with a suture needle for conductive dissection, and a

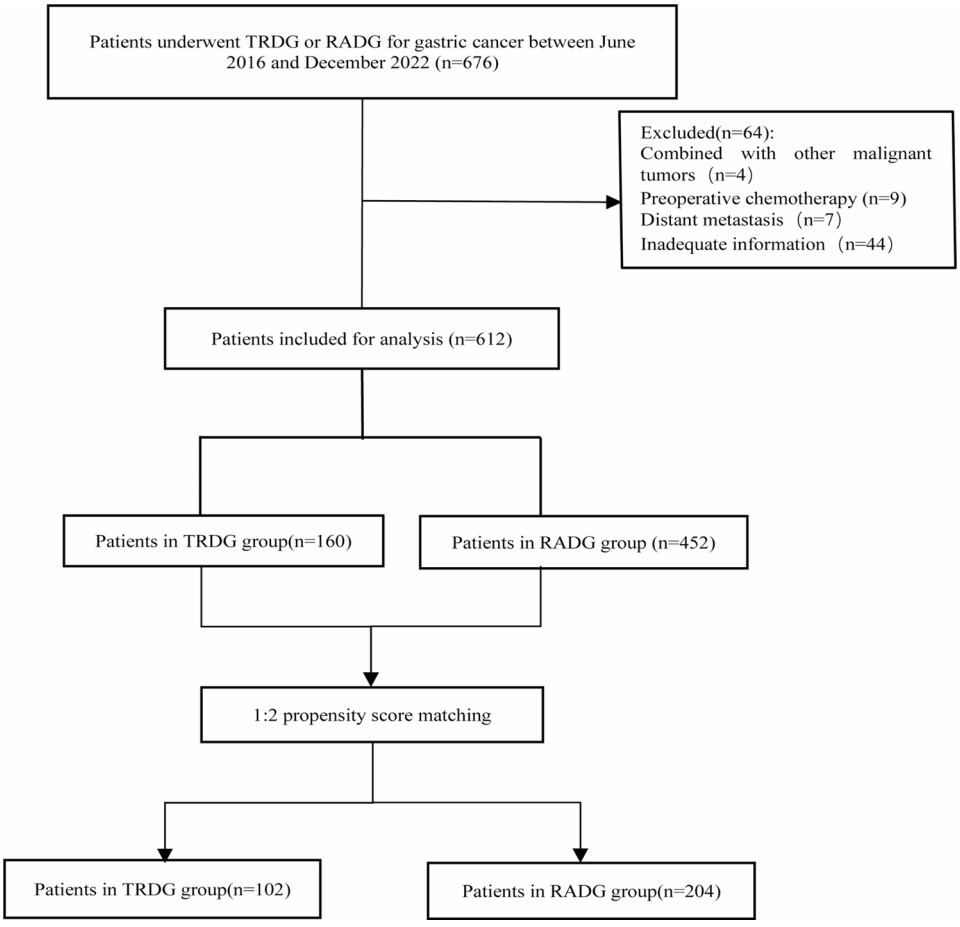

Fig. 1 The flowchart of patient enrollment

straight-line cutting obturator was placed through the right assistant's hole for remnant gastric anastomosis of the jejunum, followed by consecutive sutures to close the common opening. Continuous suture reinforcement of the residual gastric stump and full purse-string encapsulation of the duodenal stump with absorbable thread. Warm distilled water was used to rinse the abdominal cavity, drainage tubes were placed and then an appropriately sized incision was taken at the observation hole and the specimen was removed in a specimen bag.

The way of digestive tract reconstruction in the RADG group: residual gastric anastomosis of the jejunum assisted by abdominal incision. The surgical procedure is: a 5–7 cm incision is made in the middle of the epigastrium. Stump suture reinforcement after duodenal dissection by linear cutting closure. The jejunum is placed against the mesosalpinx margin, the gastric wall is incised in the greater curvature of the stomach, and a circular stapler anastomosis is inserted into the gastric lumen and guided from the appropriate part of the posterior wall to complete the residual gastric anastomosis to the jejunum. The residual stomach was reinforced with continuous sutures after dissecting the gastric body with a straight cutting obturator. The incision was closed after rinsing the abdominal cavity with warm distilled water and drain placement. The critical operation is illuminated in Fig. 2.

Data collection and follow-up

Each case was asked to report demographic information, preoperative diagnosis, operative status, postoperative pathology, postoperative complications, and rehabilitation information. (1) The Body Imagery Questionnaire (BIQ) assesses patients' attitudes toward their physical appearance and satisfaction with the appearance of the scar at 3 months postoperatively. This score has been validated in patients undergoing cholecystectomy [6] and nephrectomy [7]. (2) EORTC QLQ - C30 scale to assess patients' quality of life at 3 months postoperatively [8]. (3) The Patient Scar Assessment Questionnaire and Scoring System (PSAQ) assesses the patient's cosmetic outcome at 3 months postoperatively, which is used to evaluate the outcome of any surgical treatment of linear scarring [9].

Statistical analysis

The PSM method was utilized to balance the baseline information between the two groups at a ratio of 1:2 to

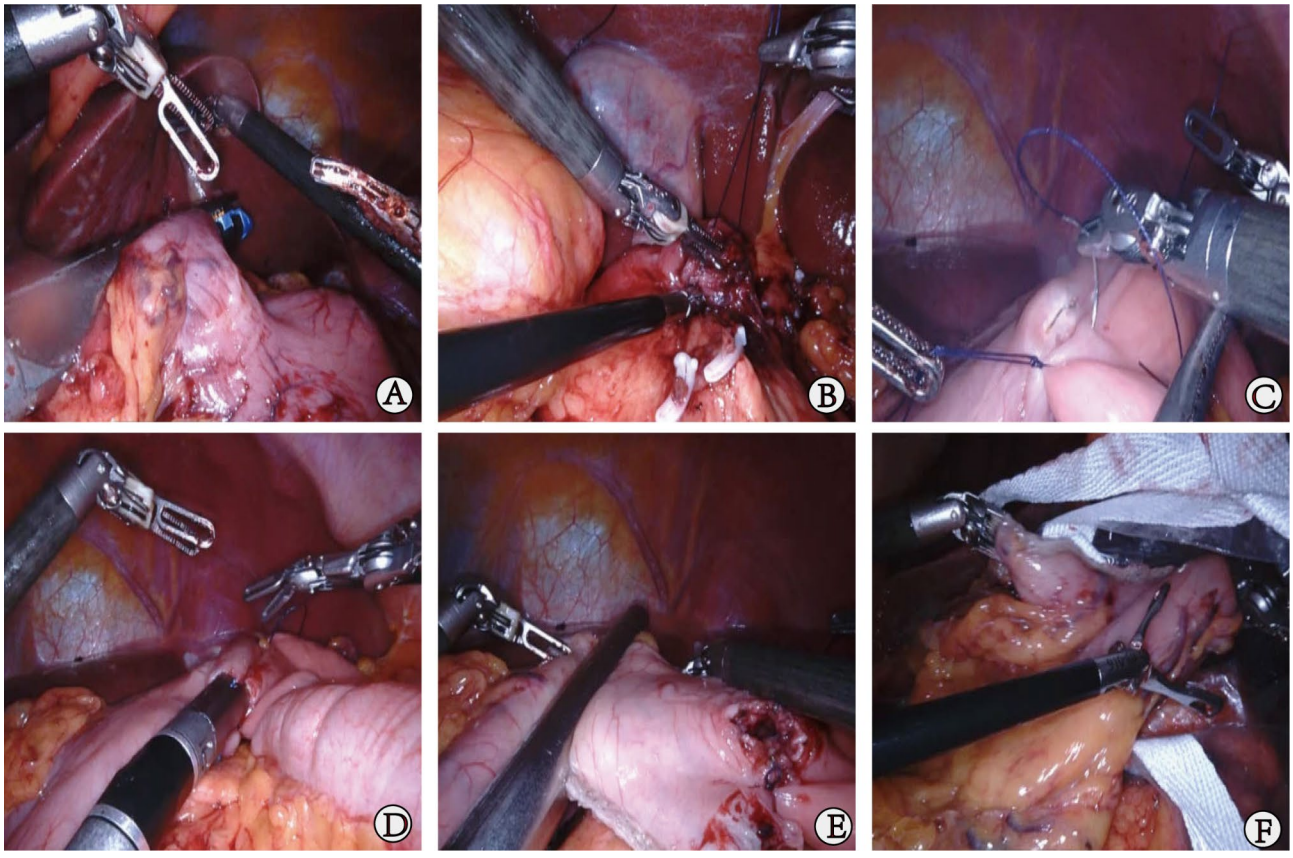

Fig. 2 Key surgical steps of totally robotic distal gastrectomy surgery (A–F). (**A**) Duodenal disconnection; (**B**) Embedding of duodenal stumps; (**C**) Suture conductivity is incised at the preanastomosis; (**D**) Closing the common opening; (**E**) Dissociation of tumor specimens; (**F**) Place specimen in specimen bag

reduce the selectivity bias. A logistic regression model was used to assign variables to baseline information of patients with a caliper value of 0.05. Normally distributed measurement data were expressed as mean±SD, while the non-normally distributed data were expressed as median and quartiles. Statistical significance was determined using the independent samples t-test or Mann-Whitney U test, respectively. Count data were expressed as frequencies and percentages and were compared to the $\chi 2$ test or Fisher's exact probability method. A two-factor repeated measures ANOVA was adopted to compare the continuous variables such as postoperative WBC, postoperative CRP, and VAS scores. $P<0.05$ was considered statistically significant. All statistical analyses were performed using IBM SPSS version 26.0 (IBM Corporation, Armonk, NY).

Results

Patient characteristics between TRDG group and RADG group

In this study, patients were propensity score-matched for sex, age, BMI, ASA score, maximum tumour diameter, degree of histological differentiation, pathological TNM stage, pathological T stage, pathological N stage, and Lauren classification. 306 patients were successfully matched. Before propensity matching, the distribution of Pathological TNM stage ($P=0.009$) and Pathological N Stage ($P<0.001$) in the TRDG and RADG groups was not balanced. After PSM, the baseline information of all 306 patients was balanced and comparable ($P>0.05$) (Table 1).

Comparison of perioperative indexes between TRDG group and RADG group

In the perioperative data of the two groups, the operative time (TRDG group 149.3±34.4 min vs. RADG group 142.7±36.7 min, $P=0.128$) and intraoperative blood loss (TRDG group 74.4±35.2 ml vs. RADG group 79.1±27.7 ml, $P=0.198$) were similar. However, the TRDG group was superior to the RADG group in terms of postoperative recovery of gastrointestinal function (TRDG group 49.3±17.3 h vs. RADG group 54.4±19.1 h, $P=0.025$). As a result, the number of postoperative hospitalization days was significantly less in the TRDG group than in the RADG group (TRDG group 8.5±4.3 day vs. RADG group 10.0±4.6 day, $P=0.006$). However, hospitalization costs remained at the same level in both groups (TRDG group 11078.6±3082.0$ vs. RADG

Table 1 Comparison of baseline data between TRDG group and RADG group before and after propensity score matching

Baseline characteristics	Before PSM			After PSM		
	TRDG($n=160$)	RADG($n=453$)	*p*	TRDG($n=102$)	RADG($n=204$)	*p*
Age at surgery, median (IQR), years	59(49–64)	58(52–64)	0.540	59(51–64)	59(52–64)	0.900
Sex, n (%)			0.335			0.626
Male	85(53.1)	260(57.5)		54(52.9)	114(55.9)	
Female	75(46.9)	192(42.5)		48(47.1)	90(44.1)	
ASA score, n (%)			0.254			0.842
1	41(25.6)	89(19.7)		21(20.6)	37(18.1)	
2	72(45.0)	210(46.5)		50(49.0)	100(49.1)	
3	47(29.4)	153(33.8)		31(30.4)	67(32.8)	
BMI, median (IQR), kg/m^2	21.7(19.8–24.4)	21.8(19.8–23.8)	0.532	21.5(19.4–24.1)	21.8(19.8–23.9)	0.792
Maximum tumour diameter, median (IQR), cm	4.0(3.0–5.0)	4.0(3.0–5.0)	0.425	4.0(3.0–5.0)	4.0(3.0–5.0)	0.327
Histological differentiation, n (%)			0.067			0.406
Well	23(14.4)	104(23.0)		23(22.5)	39(19.1)	
Moderate	72(45.0)	187(41.4)		45(44.2)	81(39.7)	
Poor	65(40.6)	161(35.6)		34(33.3)	84(41.2)	
Pathological TNM stage, n (%)			0.009			0.969
I	51(31.9)	98(21.7)		21(20.6)	41(20.1)	
II	62(38.7)	168(37.2)		36(35.3)	75(36.8)	
III	47(29.4)	186(41.1)		45(44.1)	88(43.1)	
Pathological T stage, n (%)			0.105			0.796
1	31(19.3)	89(19.7)		15(14.7)	30(14.7)	
2	62(38.8)	138(30.5)		26(25.5)	60(29.4)	
3	47(29.4)	178(39.4)		46(45.1)	91(44.6)	
4	20(12.5)	47(10.4)		15(14.7)	23(11.3)	
Pathological N Stage, n (%)			<0.001			0.766
0	61(38.2)	126(27.9)		31(30.4)	60(29.4)	
1	49(30.6)	95(21.0)		22(21.5)	39(19.1)	
2	21(13.1)	120(26.5)		21(20.6)	53(26.0)	
3	29(18.1)	111(24.6)		28(27.5)	52(25.5)	
Lauren classification, n (%)			0.771			0.443
intestinal	84(52.5)	246(54.4)		58(56.9)	109(53.4)	
diffuse	49(30.6)	125(27.7)		30(29.4)	55(27.0)	
mixed	27(16.9)	81(17.9)		14(13.7)	40(19.6)	

Note Values are presented as mean ± SD, median and IQR (interquartile range), or n (%)

Abbreviations RADG, robotic-assisted distal gastrectomy; TRDG, total robotic distal gastrectomy. BMI, body mass index; ASA, American society of anesthesiologists

group 10942.3±3940.9$, $P=0.760$). In addition, the total incision length was shorter in the TRDG group than in the RADG group (TRDG group 6.8±0.3 cm vs. RADG group 10.6±0.9 cm, $P<0.001$). There were 21 complications in the TRDG group, with 4 anastomotic fistulas and 2 anastomotic hemorrhages. In the RADG group, there were 38 complications, with 8 anastomotic fistulas and 3 anastomotic hemorrhages. There were 38 complications in the RADG group, including 8 anastomotic fistulas and 3 anastomotic hemorrhages. There was no statistically significant difference between the two groups in terms of complications. It is worth mentioning that no wound-related complications occurred in the TRDG group, while seven occurred in the RADG group. In the pathologic data, the number of lymph nodes ($P=0.506$), nerves ($P=0.141$), and vascular invasion ($P=0.494$) harvested in the two groups were not significantly different (Table 2). In the postoperative inflammatory response data of the two groups, the indexes of white blood cell counts and C protein response levels were lower in the TRDG group than in the RADG group on postoperative days 1, 3, and 5 ($P<0.001$, $P<0.001$). The VAS scores in the TRDG group were lower than in the RADG group ($P<0.001$), and at the same time, the TRDG group required fewer additional analgesic medications than did the RADG group ($P=0.013$) (Table 3; Fig. 2).

Comparison of short-term quality of life between TRDG group and RADG group

In this study, the Body image questionnaire was used to compare the body imagery of the two groups of patients at 3 months postoperatively. The questionnaire has 8 scoring items. Of these, items 1–5 assessed the Body image scale and items 6–8 assessed the Cosmetic scale.

Table 2 Comparison of postoperative conditions between TRDG group and RADG group after PSM

outcome	After PSM		
	TRDG($n=102$)	RADG($n=204$)	*p*
Operative time, mean(SD), min	149.3(34.4)	142.7(36.7)	0.128
Estimated blood loss, mean(SD), ml	74.4(35.2)	79.1(27.7)	0.198
1st flatus, mean(SD), hour	49.3(17.3)	54.4(19.1)	0.025
1st oral feeding, mean(SD), hour	68.3(20.2)	73.0(16.4)	0.031
Postoperative hospital stay, mean(SD), d	8.5(4.3)	10.0(4.6)	0.006
Total length of abdominal incision, mean(SD), cm	6.8(0.3)	10.6(0.9)	<0.001
Total hospitalization cost, mean(SD),$	11078.6(3082.0)	10942.3(3940.9)	0.760
Postoperative complication, n(%)	21(20.6)	38(18.6)	0.682
Anastomotic leakage	4(3.9)	8(3.9)	
Anastomotic bleeding	2(2.0)	3(1.5)	
Ileus	3(2.9)	3(1.5)	
Wound-related	0(0)	7(3.4)	
Urinary retention or infection	2(2.0)	2(1.0)	
Pulmonary infection	5(4.9)	3(1.5)	
Vomiting	3(2.9)	5(2.5)	
Others	2(2.0)	7(3.4)	
Harvested lymph nodes, median (IQR), n	25.0(21.0–31.0)	25.0(20.0–31.0)	0.506
Perineural invasion, n(%)	75(73.5)	133(65.2)	0.141
Lymphatic or vascular invasion, n(%)	65(63.7)	138(67.6)	0.494
Positive margin	0(0)	0(0)	NA

Note Values are presented as mean ± SD, median and IQR (interquartile range), or n (%)

Abbreviations RADG, robotic-assisted distal gastrectomy; TRDG, total robotic distal gastrectomy

Table 3 Comparison of postoperative stress response and pain condition of patients between TRDG group and RADG group

Variable	After PSM		
	TRDG($n=102$)	RADG($n=204$)	*p*
Postoperative white blood cell, mean(SD), count /l			<0.001*
Day 1	12.9(2.2)	13.5(2.9)	
Day 3	11.0(2.2)	11.2(2.7)	
Day 5	8.7(2.2)	9.6(2.7)	
Postoperative C-reactive protein, mean(SD), mg/l			<0.001*
Day 1	68.3(13.8)	73.3(14.8)	
Day 3	44.0(13.6)	48.4(15.0)	
Day 5	31.4(13.6)	37.0(14.1)	
VAS score, ,mean(SD)			<0.001*
Day 1	3.7(1.2)	5.0(1.3)	
Day 3	2.6(1.1)	3.5(1.4)	
Day 5	1.5(0.7)	2.0(1.0)	
Usage of additional analgesics, (n)%	18(17.6)	63(30.9)	0.013

Note Values are presented as Mean (SD). *The p value was calculated by a two-way repeated measures ANOVA

Abbreviations RADG, robotic-assisted distal gastrectomy; TRDG, total robotic distal gastrectomy

Table 4 Comparison of BIQ scores of patients in TRDG group and RADG group after PSM

Subscale	After PSM		
	TRDG($n=102$)	RADG($n=204$)	*p*
Body image scale (1–5),median(IQR)	7.0(6.0–7.3)	9.0(8.0–10.0)	<0.001
Cosmetic scale (6–8),median(IQR)	21.0(20.0–22.0)	19.0(17.0–19.0)	<0.001
Body image questionnaire, median(IQR)	27.0(26.0–29.0)	27.0(27.0–28.0)	0.015

Note Values are presented as median and IQR (interquartile range)

Abbreviations RADG, robotic-assisted distal gastrectomy; TRDG, total robotic distal gastrectomy

The BIQ scores in the TRDG group were better than those in the RADG group ($p=0.015$) (Table 4; Fig. 3). In terms of quality of life assessment at 3 months postoperatively, the TRDG group had better physical functioning ($P=0.039$), role functioning ($P=0.046$), and overall health functioning ($P=0.021$) than the RADG group. Meanwhile, the TRDG group had milder symptoms of fatigue ($P=0.037$) and pain ($P<0.001$) (Fig. 4). Meanwhile, the PASQ Total Subscale Score ($P<0.001$) and Global Subscale Score ($P<0.001$) were significantly lower in the TRDG group than in the RADG group at 3 months postoperatively (Table 5).

Discussion

Standard radical surgery for gastric cancer with D2 lymph node dissection to treat the disease also brings trauma and functional damage to patients. With the development of gastric cancer surgery, it is the expectation of patients and the pursuit of physicians to preserve the function of the residual stomach as much as possible under the premise of guaranteeing the effect of surgical treatment and minimizing the impact on the quality of life of patients after surgery [10]. This study focuses on the effects of fully robotic intra-abdominal anastomosis and extra-abdominal anastomosis on patients' cosmetic outcomes and postoperative quality of life, with the expectation of exploring the concept of function-preserving gastrectomy with a guaranteed prognosis.

The most commonly used indicator of the superiority or inferiority of the two procedures is the perioperative data. The operation time and postoperative blood loss were similar in both groups in this study. However, the gastrointestinal recovery function in the TRDG group was better than that in the RADG group, probably because the postoperative incision in the TRDG group

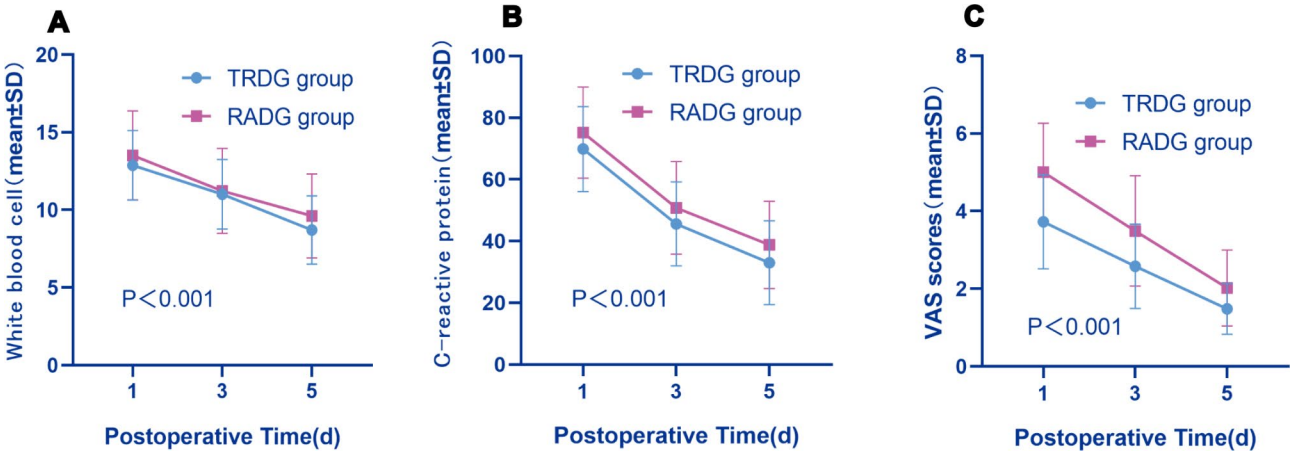

Fig. 3 Comparative perioperative indexes between two groups. (**A**–**C**). (**A**) white blood cell scores; (**B**) C-reactive protein scores; (**C**) VAS scores; *Note*: The P-value was calculated by repeated measures statistical analysis. VAS, visual analogue scale. *Abbreviations*: RADG, robotic-assisted distal gastrectomy; TRDG, total robotic distal gastrectomy

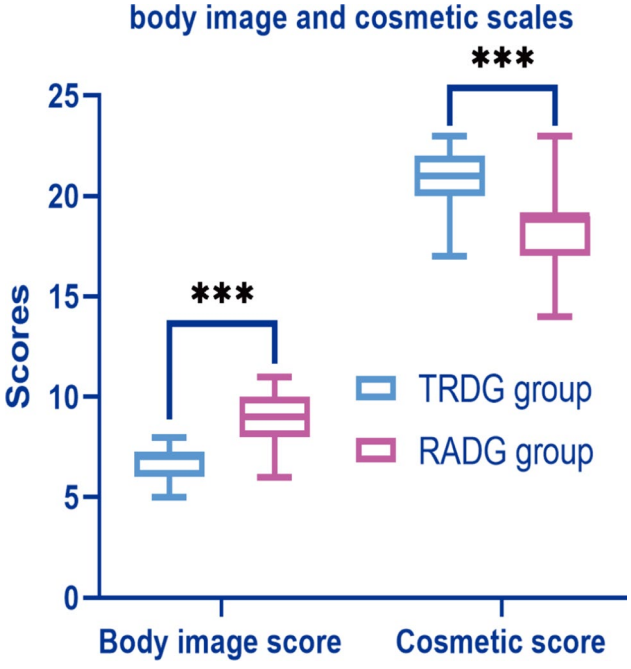

Fig. 4 Comparison of Comparative body imagery questionnaire (BIQ) Between two groups. *Note*: The body image score (among 5 and 20, a lower score means better body image). Cosmetic score (among 3 and 24, a higher score means better cosmetic results). ***$P < 0.001$. *Abbreviations*: RADG, robotic-assisted distal gastrectomy; TRDG, total robotic distal gastrectomy

was small, the patients got out of bed earlier in the postoperative period, and the gastrointestinal peristalsis was faster. Furthermore, the postoperative hospitalization time in the TRDG group is less than that in the RADG group, which is more in line with the concept of rapid recovery [11]. The number of lymph nodes harvested and the absence of positive margins in the postoperative period reflect the feasibility of robotic endoluminal anastomosis.

Several randomized controlled studies [12, 13] have confirmed the advantages of robotic radical gastrectomy in terms of lower complication rate, higher number of lymph node dissection, and faster postoperative recovery. However, the minimally invasive advantage was not fully utilized by adopting open assisted incisional anastomosis intraoperatively. The absence of wound-related complications in the TRDG group in this study further confirmed the advantages of robotic endoluminal anastomosis. The longer the abdominal exposure, the greater the loss of abdominal fluid and the greater the disruption of the patient's internal environmental homeostasis by surgery. It has been suggested that the stress response to surgery may accelerate the progression of pre-existing micrometastases or may trigger further tumor dissemination [14, 15]. Inflammatory response indexes in the TRDG group were lower than those in the RADG group at 1, 3, and 5 days postoperatively, indicating that the TRDG group interfered less with the homeostasis of the body's internal environment, which was more conducive to the recovery of the patients.

Postoperative cosmetic outcomes and quality of life reflect patients' subjective assessment of life satisfaction and well-being. Yet this is the aspect most likely to be neglected in most studies. A meta-analysis [16] showed that robotic surgery has better body function and cosmetic outcomes for patients. Perceived body image is an essential psychological consideration for gastric cancer patients, and poorer body image is associated with poor mental health outcomes [17, 18]. However, it is worth noting that patients' perceptions of their body image after minimally invasive surgery may be affected by confounding clinical factors such as incision length, poor scar healing, and incisional hernia [19]. Both body imagery and cosmetic effects were better in the TRDG group than in the RADG group in this study, which is consistent

Table 5 Comparison of PSAQ responses of patients between TRDG group and RADG group

Subscale	Total subscale score			Global subscale score		
	TRDG($n=102$)	RADG($n=204$)	*P*	TRDG($n=102$)	RADG($n=204$)	*P*
Appearance	14.0(11.0–16.0)	14.0(13.0–17.0)	0.003	2.0(1.0–3.0)	3.0(1.0–3.0)	0.009
Symptoms	9.0(7.0–14.0)	10.0(8.0–12.0)	0.033	2.0(1.0–3.0)	2.0(2.0–3.0)	0.010
Scar Consciousness	7.0(6.0–9.0)	8.0(7.0-9.5)	0.008	2.0(1.0–3.0)	2.0(1.0–3.0)	0.865
Satisfaction with Appearance	9.0(8.0–9.0)	10.5(9.0–13.0)	<0.001	2.0(1.0–3.0)	2.0(2.0–3.0)	0.029
Satisfaction with Symptoms	8.0(6.0–9.0)	7.0(6.0–9.0)	0.366	2.0(1.0–3.0)	2.0(2.0–3.0)	<0.001
Total	48.0(45.0–52.0)	50.5(47.0–61.0)	<0.001	11.0(8.0–12.0)	12.0(10.0–13.0)	<0.001

Note Values are presented as median and IQR (interquartile range)

Abbreviations RADG, robotic-assisted distal gastrectomy; TRDG, total robotic distal gastrectomy. PSAQ, Patient Scar Assessment Questionnaire and Scoring System

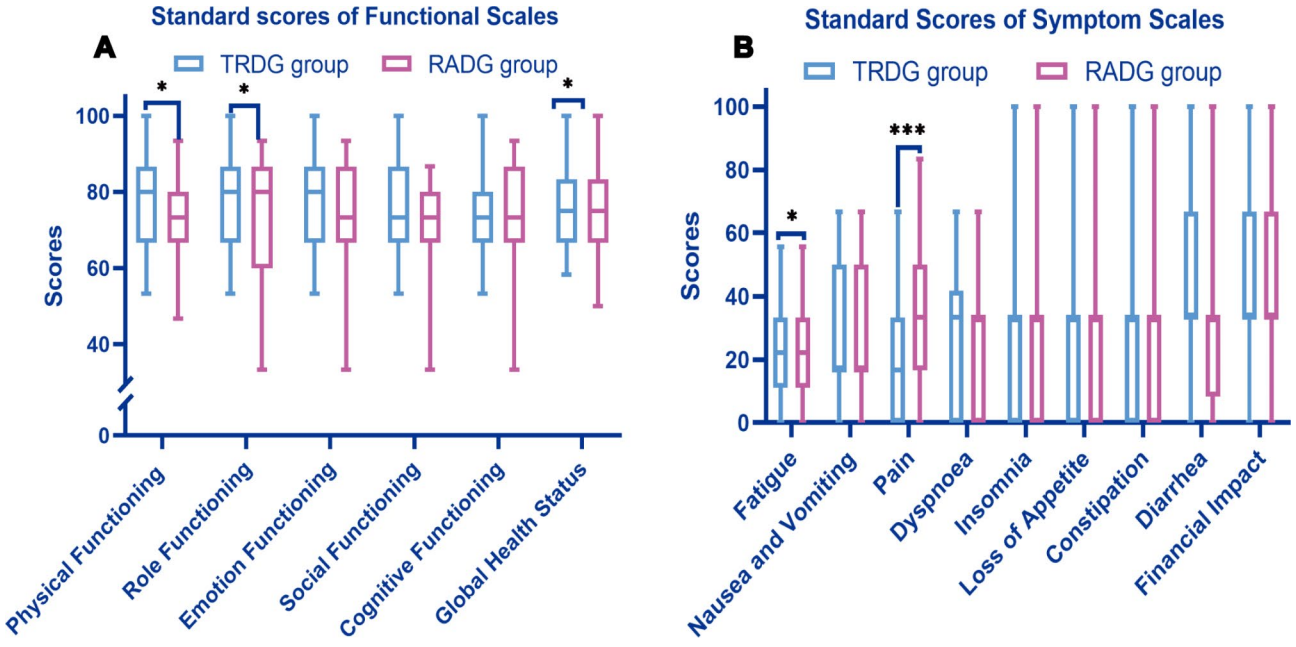

Fig. 5 Comparison of EORCT quality of life questionnaire-core 30 results Between two groups after propensity score matching (**A**-**B**). (**A**) Functional scales between two groups (a higher score means better functional results); (**B**) symptom scales between two groups (a lower score means better symptom results). *$P<0.05$, **$P<0.01$, ***$P<0.001$. *Abbreviations*: RADG, robotic-assisted distal gastrectomy; TRDG, total robotic distal gastrectomy

with the findings in the PSAQ. The EORTC QLQ - C30 scale is divided into a functional scale and a symptom scale, which has been validated in breast cancer [20] and prostate cancer [21]. The study showed better results in the TRDG group than in the RADG group, which may be due to the fact that the larger the postoperative surgical scar, the more negative the patient's psychological cues about cancer treatment, the more irritable and panicky the patient is, and the worse the results are shown by the EORTC QLQ - C30 scale.

In addition to the smaller incision size observed in the TRDG group, the superior outcomes may also be attributed to the type of anastomosis used. Although not specified in our original report, there is growing evidence in the literature supporting the superiority of the linear stapler over the circular stapler for gastrointestinal anastomosis. Several meta-analyses [22] have demonstrated that the linear stapler is associated with lower anastomotic leakage rates, reduced postoperative complications, and improved overall recovery outcomes compared to the circular stapler. We will further investigate this point in future studies.

Of course, the present study may have some limitations. First, this study is a retrospective study. Although we used propensity score matching method to adjust for potential factors, there may still be some selection bias. Second, this study mainly used questionnaires to quantify the indicators, and even though we asked patients to fill out the questionnaires as objectively as possible, we still could not avoid the existence of some patients' subjective feelings. Third, the sample size of this study needs to be increased, and more prospective and multicenter studies are needed to verify it.

Conclusion

Totally robotic distal gastrectomy has a smaller incision, faster gastrointestinal recovery time, fewer days of postoperative hospitalization, and lower inflammatory markers than robotic-assisted distal gastrectomy. At the same time, postoperative cosmetic and quality of life outcomes were satisfactory. Clinically, these benefits translate to enhanced patient recovery, reduced surgical trauma, and better postoperative outcomes. These findings could guide surgeons in selecting more effective surgical approaches for patients undergoing gastrectomy, leading to better overall patient satisfaction and outcomes.

Abbreviations

RADG	Robotic assisted distal gastrectomy
TRDG	Total robotic distal gastrectomy
BMI	Body mass index
ASA	American society of anesthesiologists
PSAQ	Patient Scar Assessment Questionnaire and Scoring System

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None.

Author contributions

JHQ and YYL designed the study; LTY and LDN performed surgical operations; GGM, LT and LYX collected data; LYH and LY analyzed the data and wrote the manuscript; JHQ and GFJ proofread and revised the manuscript. All authors read and approved the final manuscript.

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Data availability

Access to the database can be obtained from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study protocol was approved by the institutional review board (IRB) of our center. All procedures were in accordance with the ethical standards of the Center and the requirements of the Declaration of Helsinki. All patients have signed an informed consent form.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Competing interests

The authors declare no competing interests.

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