


# Application of da Vinci robot with the “3+2” mode in radical gastrectomy for gastric cancer

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## Abstract

The aim of this study is to investigate the feasibility and advantages of the da Vinci robotic system with the “3+2” mode (3 robotic arms and 2 assistants) in radical gastrectomy for gastric cancer.

The clinical data of 65 patients who underwent da Vinci robotic gastrectomy with the “3+2” mode from July 2016 to October 2019 were grouped into an observation group. An additional 65 patients who underwent robotic gastrectomy under the classic mode during the same period were grouped into a control group. The short-term surgical outcomes were compared between 2 different groups.

Compared with the control group, the observation group had a significantly shorter operative time ( $176.18 \pm 15.49$  vs  $203.85 \pm 12.77$  minutes,  $P < .001$ ) and lower operation costs ( $\$2761.19 \pm \$191.91$  vs  $\$3690.91 \pm \$162.82$ ;  $P < .001$ ). No statistical differences in other outcomes were observed ( $P > .05$ ).

We show that robotic gastrectomy with “3+2” mode is a safe and beneficial surgical procedure in new robotic surgery institutions.

**Abbreviations:** 3+2 mode = 3 robotic arms and 2 assistants, BMI = body mass index, CG = control group, CIs = Confidence intervals, DVRS = da Vinci robotic system, OG = observation group.

**Keywords:** “3+2” mode, da Vinci system, gastric cancer, robotic gastrectomy

## 1. Introduction

Gastric cancer is the fifth most malignant tumor worldwide, and one of the most common gastrointestinal cancers.<sup>[1,2]</sup> Due to its

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high incidence rate, strong invasion ability, and low cure rate, gastric cancer is still a major problem influencing the health of patients.<sup>[3–5]</sup> At present, surgery is the primary approach in treating gastric cancer. In recent years, with the development of minimally invasive techniques, robotic gastrectomy has attracted extensive attention.<sup>[6]</sup> Although numerous studies have confirmed the safety and feasibility of robotic radical gastrectomy, the long operative time and high costs still restrict the further promotion of this approach.<sup>[7,8]</sup>

The primary da Vinci robotic system (DVRS) was composed of 2 mechanical arms and 1 camera arm, which was later upgraded into 3 mechanical arms and 1 camera arm. Currently, most institutions utilize the classic mode to perform da Vinci robotic gastrectomy, where 4 robotic arms and 1 assistant are involved. However, no relevant research has focused on the relationship between the clinical efficacy of da Vinci robotic gastrectomy and the number of robotic arms or assistants. Since the introduction of robotic gastrectomy in our hospital, our team has been investigating new methods to reduce surgical costs and operative time. We were the first to use the DVRS with the “3+2” mode, which means 3 robotic arms (2 operating arms and 1 camera arm) and 2 assistants. The operation of the third robotic arm was replaced by 1 assistant based on the classic mode. The clinical data of patients in our department treated by da Vinci robotic gastrectomy with the “3+2” mode and the classic mode were retrospectively analyzed. Therefore, the aim of this study is to evaluate the effectiveness, safety, and advantages of da Vinci robotic gastrectomy with the “3+2” mode. Additionally, the utilization and experiences of the first assistant in aspirating, pulling, exposing, and separating using the attractor to assist the surgeon to complete the radical gastrectomy were summarized.

## 2. Materials and methods

### 2.1. Clinical data

Clinical data of 65 patients treated by the da Vinci robotic gastrectomy with the “3+2” mode in the department of General Surgery, Gansu Provincial Hospital, China from July 2016 to October 2019, were retrospectively analyzed. These 65 cases were grouped into an observation group (OG). An additional 65 patients that underwent classic robotic gastrectomy during the same period were selected and grouped into a control group (CG). Before surgery, all patients were examined by gastroscopy and pathological results were confirmed. Moreover, abdominal color Doppler ultrasound and abdominal enhanced computer tomography were performed for preoperative clinical staging and in order to exclude distant metastases, cardiopulmonary disorders, and surgical contraindications. All procedures were carried out with informed consent, including that for the additional costs of robotic surgery. This study was approved by the Ethics Committee of the Gansu Provincial hospital.

### 2.2. Surgical layout of the da Vinci robot with the “3+2” mode

The DVRS with the “3+2” mode involves the application of 3 robotic arms (2 mechanical arms and 1 camera arm) and 2 assistants. The entire surgical layout includes the anesthesiologist and an anesthesia monitor placed at the side of the patient’s foot, the surgical instrument carts on the left side (one is equipped with a laparoscope and a robotic surgical instrument, and the other with an open surgical instrument). The first assistant is on the left side of the patient, adjacent to the instrument nurse. The second assistant is located on the right side of the patient. A display is placed at the opposite side of each assistant. The position of the DVRS is proximal to the head of the patient, and the operator’s console is fixed at a corner of the operating room.

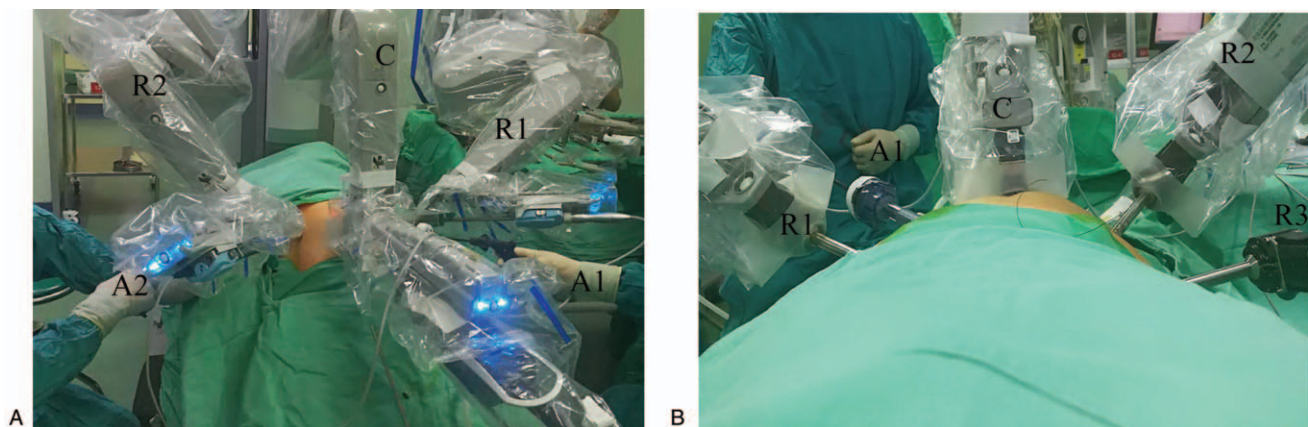
### 2.3. Trocar position of da Vinci robotic gastrectomy with the “3+2” mode

The trocar position in da Vinci robotic gastrectomy with the “3+2” mode was determined based on our previous investigation and experience. First, a 12 mm trocar was inserted as the observation

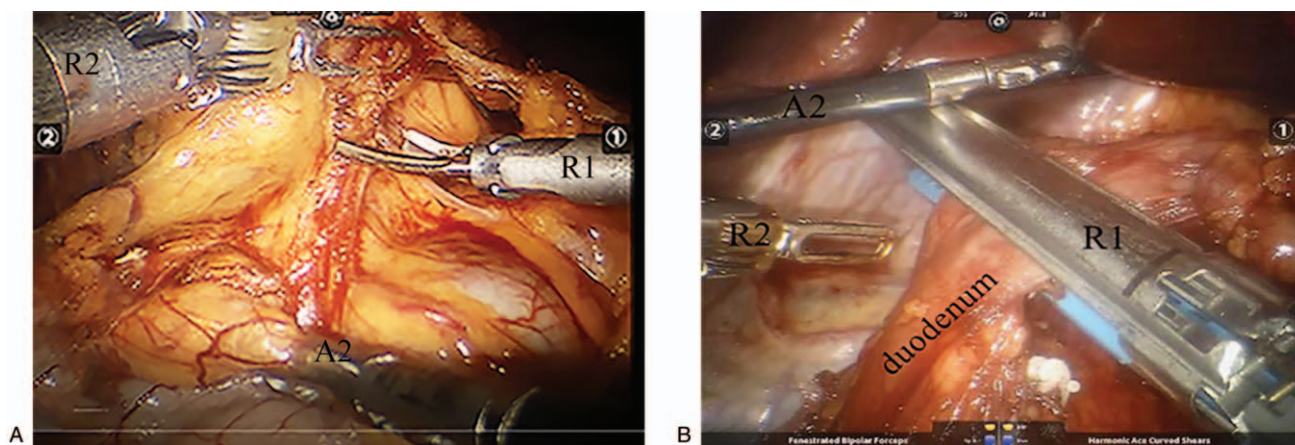
port through a 1.2 cm vertical incision, 2 cm below the umbilicus. The pneumoperitoneum was established using CO<sub>2</sub> and the pressure was maintained at 12 mm Hg. An 8 mm trocar was placed 2 cm below the left anterior axillary line under direct vision, and the first robotic arm was installed. A 12 mm trocar was inserted in the left mid-clavicular line at the umbilical level, which would act as the first assistant’s port site. An 8 mm trocar was inserted by the same method in the right mid-clavicular line at the umbilical level to install the second robotic arm. A 5 mm trocar was placed 1 cm in the subcostal margin on the right midline axillary line, which was the second assistant’s port site. The positions of all trocars were adaptable to patients’ body (Fig. 1A).

### 2.4. Surgical procedures

OG: After successful anesthesia, the patient was moved to the reverse Trendelenburg position of about 30° with the right side of the body inclined at 15°. Tissue punching was performed as described above, and the position of each trocar was confirmed. Distal radical gastrectomy was employed for all patients. After the EndoWrist instruments were placed in order, the liver was suspended, and the ultrasonic shear was used to divide and dissect the greater omentum toward the lower pole of the spleen. First, the left gastroepiploic vessel was identified and its root was ligated. Then, the division of the omentum was continued downward to the pylorus, and the gastrocolic ligament was divided toward the distal pylorus (Fig. 2A). The transverse mesocolon was dissected at the inferior border of the pancreas, and the pancreatic capsule was further isolated along the superior border of the pancreas. After the right gastroepiploic vein and the root of the artery were located at the inferior border of the pancreas and duodenum, they were ligated and dissected. Then, the No. 6 lymph nodes were dissected. The lesser omentum was opened and divided inferiorly to locate the roots of the right gastric artery and vein, which were then ligated and dissected. Subsequently, the duodenum was transected 1 cm distal to the pylorus using an endoscopic stapling device (Fig. 2B). The stomach was turned upside down, and in order to expose the splenic artery, the splenic sheath at the superior border adjacent to the pancreas was separated. Then, the No. 11p lymph nodes were dissected. Afterward, the common hepatic artery, and left



**Figure 1.** (A) R1, robotic first arm; R2, robotic second arm; A1, the first assistant; A2, the second assistant; C, the camera arm. (B) R1, robotic first arm; R2, robotic second arm; R3, robotic third arm; A1, the first assistant; C, the camera arm.



**Figure 2.** (A) Dissected ligaments around the stomach. (B) Disconnect the duodenum by used endo-GIA.

gastric vein and artery were exposed along the splenic artery, and the No. 7, 8, and 9 lymph nodes were dissected. In order to fully expose the proper hepatic artery along the gastroduodenal and common hepatic arteries, the capsule of the hepatoduodenal ligament was opened, and the No. 12a lymph nodes were dissected. The stomach was retracted downward to expose the cardiac orifice and the lesser curvature of the stomach, and the No. 1 and 3 lymph nodes were dissected. The robotic arms were removed from the field and a 5-cm minilaparotomy incision was performed along the midline of the epigastrium. After the stomach and surrounding omentum were pulled out through the incision, the tumor specimen was removed. After gastrectomy, gastrointestinal continuity was restored by gastroduodenostomy. Gastroduodenostomy was constructed using a 29-mm circular stapler. The minilaparotomy was closed with continuous 1–0 polydioxanone sutures and pneumoperitoneum was achieved by insufflation to 12 mm Hg. A closed suction drain would be inserted only when considerable bleeding had occurred during surgery. During the whole operation, the 2 assistants cooperated closely with the surgeon. The first assistant helped in the processes of separation, clamping, and disconnection, as well as in using a suction tube for sucking the small discontinuous flow and performing blunt separation. The second assistant was mainly responsible for organ retraction in order to provide a sufficient operative field and maintain a certain tension.

CG: The surgical procedure was similar with that of the OG. The trocar position of da Vinci robotic gastrectomy under the “classic mode” is presented in Figure 1B.

### 2.5. Observation indicators

The operative time, estimated blood loss, rate of conversion to laparotomy, postoperative day of flatus passage, postoperative hospital stay, postoperative complications, and operation costs were investigated. The operative time was measured from skin incision to skin closure, and it excluded the docking and undocking time of the robotic system. Postoperative hospital stay indicated the time after the surgery was completed until hospital discharge. The hospitalization costs of the 2 groups were not analyzed in this study, due to the large number of involved confounding factors.

### 2.6. Statistical analysis

All statistical analyses were conducted using IBM SPSS 22 (IBM Corporation, Armonk, NY). Stata software version 12.0 (Stata Corp, College Station, TX) was used in multivariate linear regression models. Continuous variables were presented either as mean  $\pm$  standard deviation or as median (interquartile range), as appropriate. The Student *t* test was applied to compare normally distributed variables, whereas the Mann–Whitney *U* test was used for non-normally distributed variables. Categorical data were analyzed using the  $\chi^2$  (Chi-square) test or the Fisher exact test. Confidence intervals (CIs) were estimated at 95%. *P*-value  $< .05$  was considered to be statistically significant.

## 3. Results

### 3.1. Patient characteristics

A total of 130 patients were included in the study. Among them, 65 patients were grouped in the OG and other 65 were included in the CG respectively. There were no differences in age, body mass index, comorbidity, tumor size, and gender. The patient characteristics are summarized in Table 1.

### 3.2. Surgical outcomes and short-term postoperative courses

The surgical outcomes and short-term postoperative courses are summarized in Table 2. Both groups of operations were successfully completed without conversion to open surgery or blood transfusion during the operation. No significant differences were found in estimated blood loss, dissected lymph node number, postoperative day of flatus passage, and postoperative hospital stay ( $P > .05$ ). The operative time of the OG was significantly shorter than that of the CG ( $176.18 \pm 15.49$  vs  $203.85 \pm 12.77$  minutes,  $P < .001$ ). After controlling for confounding factors, the multiple linear regression model showed that both the age (coefficient = 0.54, 95% CI = 0.23–0.84;  $P < .001$ ) and the body mass index (coefficient = 1.34, 95% CI = 0.09–2.58;  $P = .035$ ) were correlated with operative time (Table 3).



**Table 1**  
**Characteristics of patient between the 2 techniques.**

Patients characteristics	OG (n = 65)	CG (n = 65)	P-value
Gender (M/F)	39/26	46/19	.197*
Age (yr)	55.2 ± 7.2	57.2 ± 8.1	.156†
BMI, median (IQR), kg/m <sup>2</sup>	23.8 [22.5–24.9]	22.9 [22.4–23.7]	.134‡
Comorbidity [n (%)]	34 (52.3)	29 (44.6)	.382*
Tumor maximum diameter, mean ± SD, mm	45.4 ± 9.2	42.6 ± 9.3	.125†
TNM stage			.395*
I	12 (18.5)	8 (12.3)	
II	43 (66.2)	50 (76.9)	
III	10 (15.4)	7 (10.8)	

Values are presented as mean ± SD, or n (%); median (25th, 75th percentile) as IQR.

BMI = body mass index, CG = control group, F = female, M = male, OG = observation group, SD = standard deviation.

\*  $\chi^2$  test.

† t test.

‡ Mann–Whitney test; comorbidity, history of laparotomy.

**Table 2**  
**Surgical outcomes, short-term postoperative courses and cost analysis.**

Clinical parameters	OG (n = 65)	CG (n = 65)	P-value
Operative time (min)	176.18 ± 15.49	203.85 ± 12.77	<.001†
Estimated blood loss, median (IQR), mL	90 [65–120]	90 [60–120]	.321‡
Conversion to laparotomy [n (%)]	0	0	N/A*
Postoperative hospital stay, median (IQR), d	11 [10–12]	12 [10.5–14]	.153‡
Time to passage of flatus (d)	2.8 ± 0.6	2.6 ± 0.5	.192†
Lymph node yield, median (IQR)	30 [28–32.5]	29 [28–31]	.157‡
Operation cost (\$), mean (SD)	2761.19 ± 191.91	3690.91 ± 162.82	<.001†
Total of cost (\$), mean (SD)	10461.09 ± 401.86	11737.12 ± 910.43	<.001†

Values are presented as mean ± SD, or n (%); median (25th, 75th percentile) as IQR.

CG = control group, IQR = interquartile range, N/A = not applicable, OG = observation group, SD = standard deviation.

\*  $\chi^2$  test.

† t test.

‡ Mann–Whitney test.

**Table 3**  
**Multivariable linear regression model of factors associated with OT and OC.**

Factors	Operative time (OT)			Operation cost (OC)		
	Coeff	95% CI	P	Coeff	95% CI	P
CG*	27.41	2254 to 32.27	<.01	833.35	753.16 to 913.54	<.001
Female†	−0.25	−5.32 to 4.81	.921	37.35	−21.38 to 96.07	.231
Age (yr)	0.54	0.23 to 0.84	.001	8.14	4.43 to 11.85	<.001
BMI (kg/m <sup>2</sup> )	1.34	0.09 to 2.58	.035	−1.86	−16.53 to 12.79	.802
Largest tumor size (mm)	0.34	−0.22 to 0.29	.793	2.17	−0.8 to 5.55	.151
Lymph node yield	0.52	−0.42 to 1.46	.271	6.36	−4.59 to 17.31	.252
Estimated blood loss (mL)	0.07	−0.01 to 0.15	.089	−0.31	−1.24 to 0.62	.512
Postoperative hospital stay (d)	—	—	—	—	—	—
Time to passage of flatus (d)	—	—	—	—	—	—
Operative time (min)	—	—	—	3.49	1.41 to 5.57	<.001
Operation cost (\$)	—	—	—	—	—	—

BMI = body mass index, CG = control group, CI = confidence interval, Coeff = coefficient, OC = operation cost, OG = observation group, OT = operative time.

\* In reference to OG.

† In reference to males.

### 3.3. Early and late postoperative complications

The postoperative complications are summarized in Table 4. The rates of overall complications were classified according to the Clavien–Dindo classification grade.<sup>19]</sup> No significant differences

were found in grade ≥III (OG, 20% vs CG, 16.9%;  $P = .651$ ), local complications (OG, 18.5% vs CG, 15.4%;  $P = .645$ ), and systemic complications (OG, 3.1% vs CG, 4.6%;  $P = .573$ ) within 30 days after surgical treatment. Moreover, no late complications were observed between the 2 groups.

**Table 4**  
**Early and late complications (Clavien-Dindo grade  $\geq$ III).**

Complications	OG (n=65)	CG (n=65)	P-value
Morbidity [n (%)]	13 (20)	11 (16.9)	.651
Local complications [n (%)]	12 (18.5)	10 (15.4)	.645
Anastomotic leakage [n (%)]	1 (1.5)	2 (3.1)	.50*
Pancreatic fistula [n (%)]	1 (1.5)	0 (0)	.50*
Intraperitoneal abscess [n (%)]	2 (3.1)	1 (1.5)	.50*
Bowel obstruction [n (%)]	3 (4.6)	1 (1.5)	.312*
Intraperitoneal bleeding [n (%)]	1 (1.5)	4 (6.2)	.183*
Anastomotic bleeding [n (%)]	0 (0)	2 (3.1)	.248*
Wound infection [n (%)]	2 (3.1)	1 (1.5)	.50*
Systemic complications [n (%)]	2 (3.1)	3 (4.6)	.50*
Pneumonia [n (%)]	1 (1.5)	2 (3.1)	.50*
Cardiac disease [n (%)]	0 (0)	1 (1.5)	.50*
Pulmonary embolism [n (%)]	1 (1.5)	0 (0)	.50*
Late complication (internal hernia) [n (%)]	0 (0)	0 (0)	NA

Data are shown as n (%).  $\chi^2$  test was used for between-group comparison.

CG=control group, N/A=not applicable, OG=observation group.

\*Fisher exact test.

### 3.4. Pathological details

The postoperative pathological results of the 2 groups were basically consistent with the preoperative diagnosis. Among them, in the OG there were 29 cases of differentiated adenocarcinoma, 12 cases of poorly differentiated adenocarcinoma, 1 case of adenosquamous carcinoma, 8 cases of signet ring cell carcinoma, and 15 cases of mucinous adenocarcinoma, while in the CG there were 23 cases of mid-differentiated adenocarcinoma, 18 cases of poorly differentiated adenocarcinoma, 13 cases of well-differentiated adenocarcinoma, and 11 cases of mucinous adenocarcinoma.

### 3.5. Cost analysis

The costs analysis is presented in Table 2. The operation costs in the OG were lower than in the CG ( $\$2761.19 \pm \$191.91$  vs  $\$3690.91 \pm \$162.82$ ;  $P < .001$ ). After adjusting for potential confounders, a multivariable linear regression model showed that the operation costs in the CG were by  $\$1096.55$  higher than those in the OG ( $P < .001$ ). Meanwhile, the results revealed that the age (coefficient = 8.14, 95% CI = 4.43–11.85;  $P < .01$ ) and operative time (coefficient = 3.49, 95% CI = 1.41–5.57;  $P < .01$ ) may be some of the factors that affected the operative cost (Table 3).

## 4. Discussion

At present, DVRS is widely applied in many fields of surgery.<sup>[10]</sup> Robotic-assisted radical gastrectomy has attracted widespread attention since the Giulianotti team performed distal gastrectomy with the assistance of a robot for the first time in 2001.<sup>[11]</sup> Although the reports on robot-assisted gastric cancer surgery have increased since the first introduction of the da Vinci surgical robotic system in China in 2006, the development of robot-assisted gastrectomy has been slow. There are 2 main reasons for this:

(1) Gastrectomy involves multi-layered anatomy and the scope of lymph node dissection is wide. Thus, good cooperation in the team and the full exposure of the surgical field are the keys to a successful operation.<sup>[12]</sup>

(2) The high cost of the robotic system and its equipment maintenance, together with the high treatment expenses, restrict the popularity of robotic surgery.

Trocar distribution for classic robotic radical gastrectomy consists of 1 assistant and 4 arms. Considering that 1 surgeon needs to complete the exposure, lymph node dissection, and continuous transformation of multiple arms, it is difficult for surgeons who are new to robotic systems to perform robotic gastrectomy.<sup>[7,8]</sup> Based on continuous clinical practice, we concluded that similar surgical results could be achieved by adding 1 assistant and reducing 1 robotic arm (“3+2” mode). In addition, the operative time and the cost for frequent instrument change could be reduced. This mode also benefits the training of young doctors and shortens the learning curve of robotic gastrectomy. The results of this study showed that the average operative time of the CG was 21.37 minutes longer than that of the OG. Although the difference may not present clinical significance, the difference in operative time between the 2 groups would be further increased as the surgeons accumulate more skills and experience in da Vinci robotic radical gastrectomy using the “3+2” mode.

Robotic-assisted radical gastrectomy using the DVRS with the “3+2” mode is proposed on the basis of the experience of laparoscopic radical gastrectomy. The operation was performed by 3 people. The surgeon was mainly responsible for the adjustment of the cameras and the removal of the tumor tissue. Two assistants were involved in the surgery as well. The first assistant handled the suction device for clearing the operative field. The second assistant operated the forceps for clamping and lifting the tissue in order to fully expose the surgical field and provide tissue tension, allowing the robotic arm to perform more operations. As a result, the cost for frequent instrument replacement was decreased. The results also showed that the operative time in the OG was shorter than that in the CG. In our department, 65 cases underwent radical robotic gastrectomy with the “3+2” mode. The operation process was smooth without laparotomy, and no obvious conversion difficulty was found from laparoscopic to robotic-assisted laparoscopic surgery. In addition, it was discovered that in thinner patients, collision of

mechanical arms may occur during classic robotic gastrectomy, which was successfully avoided when the “3+2” mode was applied.

As in laparoscopic radical gastrectomy, the operation and safety of robotic radical gastrectomy is related to the exposure of the surgical field. Maintaining a clear and clean surgical field can avoid accidental injury and bleeding.<sup>[13]</sup> Under the “3+2” mode, the first assistant mainly operates the aspirator. The aspirator not only sucks the smoke generated by the ultrasonic scalpel, but also cleans the bleeding and exudation of the surgical wound. Furthermore, it can be used to assist the surgeon to perform hemostasis. Given that the da Vinci’s 3D camera is huge, once it is spattered with droplets, removing and wiping procedures are more complicated than in normal laparoscopy. Therefore, skilled use of the aspirator plays an important role in maintaining a good surgical field. During the operation, the first assistant summarized some functions and experience using the aspirator.

- (1) Suction and pressure function: during the separation process, a small amount of bleeding can be directly sucked and compressed to maintain a clear surgical field, which is convenient for the surgeon to directly perform hemostasis by electrocoagulation or clamping, as well as to reduce the instrument change and the operative time;
- (2) separate, expose, and maintain the tension of the tissue: during the isolation of the right gastro-omental vessels and the dissection of the No. 6 lymph nodes, the aspirator is pulled down to maintain the relative extension of the visual field. When the lymph nodes along the hepatic artery are dissected, pressing down on the pancreas and intermittent suction are the key factors for the dissection.

Lymph node dissection is a crucial part of radical gastrectomy. D2 lymph node dissection is one of the important factors affecting the long-term survival of patients with gastric cancer. Robot-assisted gastrectomy and D2 lymph node dissection have been proved safe and feasible, which could fulfill oncology criteria for D2 dissection.<sup>[14]</sup> Compared to laparoscopic surgery, the robotic surgery system could display high definition 3D images with 10 to 15× magnification of the micro-anatomical structure. In conventional lymphatic dissection, there is a part that cannot be reached by the straight-arm in laparoscopic surgery, and the uplift of the pancreas will also interfere with the surgeon’s operation.<sup>[15]</sup> On the contrary, the flexible “internal wrist” of the robotic surgery system helps the surgeon reach deeper parts, in order to sweep more lymph nodes.<sup>[16–18]</sup> Overall, under 3D surgical vision, the robotic surgery system can better display the micro-structures and easily achieve the vascularization of blood vessels around the stomach, and therefore, it greatly reduces the technical difficulty of lymph node dissection.<sup>[19]</sup> In this study, despite that no significant difference was found in the dissected lymph node number between the OG and the CG, robotic radical gastrectomy using the “3+2” mode made lymph node dissection easier and more complete with the aid of 2 assistants.

Despite that the application of DVRS in the surgical field becomes wider and wider, the high cost has limited the popularity of robotic surgery to some extent.<sup>[20,21]</sup> Reducing the number of assistants could partly alleviate the problem caused by the shortage of human resources. Thus, one purpose of the introduction of da Vinci robotic surgery was to lower the dependence of surgeon on assistants in order to save medical resources.<sup>[22]</sup> However, in some developing countries, such as

China, and especially in economically underdeveloped areas in Northwest China, advanced medical equipment such as the da Vinci Robot system is very scarce. The “3+2” mode, where 1 robotic arm is replaced by an assistant, not only can increase surgical flexibility, but also can reduce the cost of adding a robotic arm and consumables, due to constant instrument change. According to the research of Yim et al,<sup>[23]</sup> if the same clinical efficacy can be achieved, reducing the number of robotic arms is an effective choice to decrease the cost of surgery. In this study, the mean operative cost in the CG was by \$929.72 higher than that in the OG, and therefore the economic burden on the patient was reduced to some extent. Besides, in robotic surgery using the “3+2” mode, the first assistant is the attending surgeon with rich experience in laparoscopic surgery, while the second assistant position can be served by a young resident. As such, the young resident can be familiar with the da Vinci robotic surgery system, which is conducive to the promotion and application of robotic surgery in China. However, depending on the circumstances, these considerations may not be relevant in some developed countries or in hospitals where doctors are scarce. In some developed countries, the cost of assistants is higher than the cost of robotic arms. Therefore, the “3+2” mode would be more suitable for developing countries, such as China, or institutions that intend to increase the experience of robotic assistants.

The limitations of this study included:

- (1) The retrospective study design was subjected to inherent selection bias. However, the surgery in both groups was performed by the same surgical team and there was no statistical difference in the important baseline clinicopathologic characteristics that may affect surgical outcomes.
- (2) The long-term efficacy of robotic-assisted radical gastrectomy using the DVRS with the “3+2” mode could not be evaluated due to the lack of long-term follow-up results.
- (3) Although “3+2” mode has some clinical advantages, it eliminates some of the advantages of the robotic system itself.

In conclusion, in contrast to classic robotic radical gastrectomy, the “3+2” mode could improve the exposure of the operative field, strengthen the coordination of assistants, reduce the surgical costs, and shorten the operative time. In addition, a wider surgical field was provided when the assistant operated the aspirator expertly, reducing operation difficulty and enhancing clinical teaching. However, the long-term clinical effect of this robotic gastrectomy with the “3+2” mode still needs to be further verified by conducting high quality randomized controlled trials.

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