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ORIGINAL ARTICLE

Full robot-assisted gastrectomy with intracorporeal robot-sewn anastomosis produces satisfying outcomes

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Abstract

AIM: To evaluate the feasibility and safety of full robot-assisted gastrectomy with intracorporeal robot hand-sewn anastomosis in the treatment of gastric cancer.

METHODS: From September 2011 to March 2013, 110 consecutive patients with gastric cancer at the authors' institution were enrolled for robotic gastrectomies. According to tumor location, total gastrectomy, distal or proximal subtotal gastrectomy with D2 lymphadenectomy was fully performed by the da Vinci Robotic Surgical System. All construction, including Roux-en-Y jejunal limb, esophagojejunal, gastroduodenal and gastrojejunal anastomoses were fully carried out by the intracorporeal robot-sewn method. At the end of surgery, the specimen was removed through a 3-4 cm incision at the umbilicus trocar point. The details of the surgical technique are well illustrated. The benefits in terms of surgical and oncologic outcomes are well documented, as well as the failure rate and postoperative complications.

RESULTS: From a total of 110 enrolled patients, radical gastrectomy could not be performed in 2 patients due to late stage disease; 1 patient was converted to laparotomy because of uncontrollable hemorrhage, and 1 obese patient was converted due to difficult exposure; 2 patients underwent extra-corporeal anastomosis by minilaparotomy to ensure adequate tumor margin. Robot-sewn anastomoses were successfully performed for 12 proximal, 38 distal and 54 total gastrectomies. The average surgical time was 272.52 ± 53.91 min and the average amount of bleeding was 80.78 ± 32.37 mL. The average number of harvested lymph nodes was 23.1 ± 5.3. All specimens showed adequate surgical margin. With regard to tumor staging, 26, 32 and 46 patients were staged as Ⅰ, Ⅱ and Ⅲ, respectively. The average hospitalization time after surgery was 6.2 d. One patient experienced a duodenal stump anastomotic leak, which was mild and treated conservatively. One patient was readmitted for intra-abdominal infection and was treated conservatively. Jejunal afferent loop obstruction occurred in 1 patient, who underwent re-operation and recovered quickly.

CONCLUSION: This technique is feasible and can produce satisfying postoperative outcomes. It is also convenience and reliable for anastomoses in gastrectomy. Full robotic hand-sewn anastomosis may be a minimally invasive technique for gastrectomy surgery.

Key words: Robotic surgery; Gastric cancer; Total gastrectomy; Esophagojejunal anastomosis

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INTRODUCTION

Although laparoscopic gastrectomy has been widely performed worldwide, its role is still a matter of debate due to inherent difficulties in specific node dissection and intracorporeal anastomosis[1,2]. Recently, robotic surgery has been demonstrated to overcome the intrinsic limitations of a traditional laparoscopic approach, where the anatomical and operative conditions are similar to those encountered during gastric resection[3,4]. Several recent retrospective studies have reported that robotic surgery for the treatment of gastric cancer is feasible and can produce satisfying postoperative outcomes[5-7]. However, most studies have reported that anastomosis after robotic gastrectomy was carried out by extracorporeal hand-sewn sutures or an intracorporeal stapler.

Wristed instruments that allow seven degrees of freedom, tremor filtering, the ability to scale motions, and stereoscopic vision improve the surgeon's dexterity when fine manipulation of tissues in a close, fixed operating field or when hand-sewn sutures and knot tying are required[8]. In robotic surgery for other complex robotic procedures, such as urethral anastomosis in radical prostatectomy or valve replacement in cardiac surgery, several studies have reported that robot hand-sewn anastomosis was possible within a narrow space due to these distinct advantages[9-11]. Therefore, we believe that a robotic approach would also be relevant for laparoscopic D2 dissection and intracorporeal anastomosis by a full robot hand-sewn method.

To the best of our knowledge, no study has assessed the reliability of this hand-sewn technique or described its technical details, although it is a classic and feasible method. The current study aimed to assess the feasibility and safety of full robot-assisted total and subtotal gastrectomy with extended lymphadenectomy and intracorporeal robot-sewn anastomosis.

Here, we present the results of a preliminary study in which anastomosis after gastrectomy was successfully achieved by a robot-sewn technique. All procedures, including lymph node dissection and anastomosis, were completed by the robot, the so-called "full robot-assisted gastrectomy", which was different from previous robotic surgery for the treatment of gastric cancer.

MATERIALS AND METHODS

All procedures were performed by the da Vinci Surgical System (Intuitive Surgical, Inc, Mountain View, CA, United States). We began using this system for gastric cancer surgery in May 2010 at Jinglin Hospital, affiliated to Nanjing University, China. From September 2011 to March 2013, we conducted a prospective evaluation of the feasibility and safety of robot-assisted gastrectomy with intracorporeal robot hand-sewn anastomosis. During this time, all patients with histologically proven gastric cancer without organ invasion (T4) underwent preoperative work-up and examination. One hundred and ten consecutive patients diagnosed with gastric cancer were enrolled in this trial (details in Figure 1). Robotic anastomosis was performed by a surgeon (Dr. Jiang ZW) who had been involved with more than 100 cases of robotic-assisted gastrectomy before this trial. We obtained informed consent from all patients for administration of this robotic surgery anastomotic method.

Perioperative management was performed by adopting the measures of fast track surgery[12,13]. Preoperative short-time fasting and carbohydrate loading were introduced. Nasogastric decompression tubes were abandoned in all patients, unless absolutely necessary. When able, patients were given water from postoperative day 1, liquid diet was started on postoperative day 2, and soft diet was started on postoperative day 3. After 1 d of soft diet without complications, patients were discharged.

All data were collected prospectively. Operative time was calculated as the time between pneumoperitoneum induction and port-site closure. Intraoperative blood loss was measured by subtraction. Tumor staging and lymph node harvest rate were assessed by the pathology department. Surgical and oncologic outcomes were well documented. Patients were evaluated weekly with clinical examinations during the 30 d after discharge and then followed-up every 3 mo. We evaluated feasibility and safety of the procedure with the Clavien-Dindo classification, which categorizes surgical complications from grade 1 to 5 based on the invasiveness of the treatment required. Grade 1 requires no treatment; grade 2 requires medical therapy; grade 3a requires surgical, endoscopic, or radiologic intervention, but not general anesthesia; grade 3b requires general anesthesia; grade 4 represents life-threatening complications that require intensive care; and grade 5 represents death of the patient.

Patient and robot position, port placement

The patient is moved to the 20° reverse Trendelenburg position under general anesthesia. The camera port (C) is inserted into the infra-umbilical area for a 12 mm trocar. After establishing 12-mmHg pneumoperitoneum, the other four ports are placed with the aid of camera visualization.

Two 8-mm Intuitive cannulae for robotic devices are placed under direct visualization 2-3 fingerbreadths below the costal margin at the right and left anterior axillary line, respectively (Figure 2, trocar A and E). The last 8-mm Intuitive cannula (B) is placed in the right paraumbilical area below the level of port A and at least one handbreadth away from the camera port.

One 12-mm trocar (D) is placed along the left midclavicular line, in the left paraumbilical area and at least

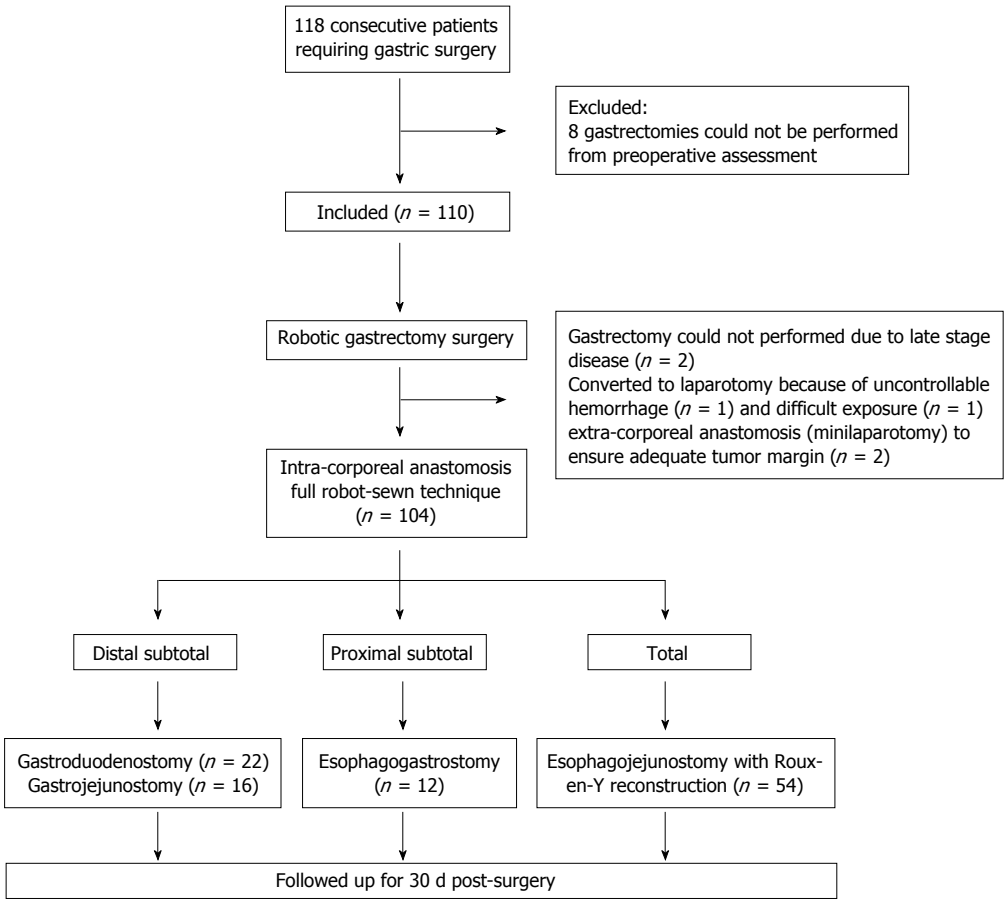

Figure 1 Flow diagram.

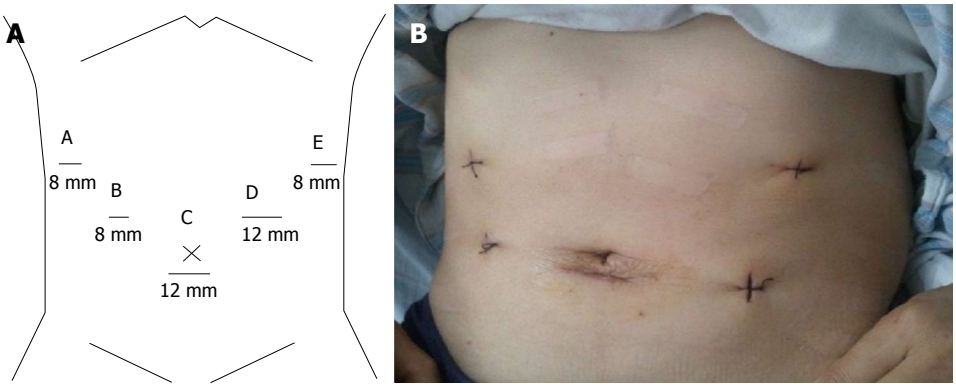

Figure 2 Placement of surgical ports. For A, B and E 8-mm ports were used. For C and D 12-mm ports were used. Port C was extended to 3 cm for specimen extraction from the abdominal cavity.

one handbreadth away from the camera port (C). The assistant who works on the patient's left side uses this port (D) to aid the surgeon during the robotic operation, such as insertion of an endo-stapler for resection of the duodenum, the stomach, or the abdominal esophagus and for placement of gauze or a suction device for clearing the operative field (Figure 2). After port placement, the robotic cart is installed from the patient's head.

In Japan and Europe, extended lymph node dissection (D2) is the standard of care for gastric cancer[14-16]. Robotic gastrectomy with D2 lymph node dissection were performed according to the rules of the Japanese Research Society for Gastric Cancer[17,18]. Total gastrectomy, distal or proximal subtotal gastrectomy was decided according to tumor location. The lymphatic tissues are removed *en bloc* along the hepatic, splenic, left gastric artery and celiac trunk using an ultrasonic shear. The origins of these arteries are clearly identified and skeletonized, and the lymphatic tissue dissected away from the adventitia. The left gastric artery is then clipped or tied at its origin

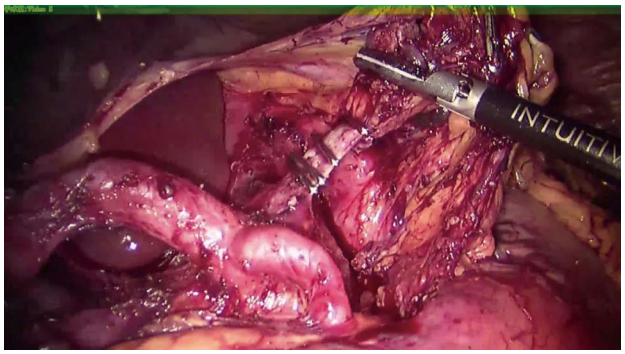

Figure 3 Lymphatic tissues are removed *en bloc* along the hepatic, splenic, left gastric artery and celiac trunk using an ultrasonic shear. The origins of these arteries are clearly identified and skeletonized, and the lymphatic tissue dissected away from the adventitia. The left gastric artery is then clipped or tied at its origin.

(Figure 3). Once the lymphadenectomy is complete, the assistant divides the stomach, intestine or esophagus using multiple endostapler applications (Ethicon Endo-Surgery, Cincinnati, United States) from the 12 mm trocar D. The specimen, including the stomach, omentum, and the lymphatic tissue, are wrapped by an endobag. The specimen was extracted from the abdominal cavity through the intraumbilical port site extended to 3 cm.

Distal subtotal gastrectomy with gastroduodenostomy (Billroth Ⅰ) and gastrojejunostomy (Billroth Ⅱ)

After distal subtotal gastrectomy, 38 patients underwent gastroduodenostomy or gastrojejunostomy reconstruction. For gastroduodenostomy, the duodenum was resected by an endo-linear stapler inserted into the assistant's 12 mm trocar D. The remnant portion of the lesser curvature was resected by an endo-linear stapler, and the completely resected stomach was then wrapped by an endobag. The posterior walls of the duodenum and the stomach were approximated by continuous seromuscular sutures (Figure 4B and C); the duodenal stump was then opened by an ultrasonic shear. A continuous suture with interlocking of the full intestinal layers of the posterior and anterior wall of the duodenum and the stomach was then made (Figure 4D and F). Finally, the anterior wall of the anastomosis was reinforced by interrupted seromuscular sutures (Figure 4G). Sometimes, the duodenum was not transected until the posterior wall suturing of the gastroduodenostomy was finished. This method can facilitate pulling up the duodenum for anastomosis. The duodenum was totally dissected using an ultrasonic scalpel (Figure 4C and E). For gastrojejunostomy reconstruction, the jejunum which is about 20 cm away from the Treitz was brought up just below the remnant stomach for antecolic end-to-side anastomosis, which was achieved using the hand-sewn technique in the same manner.

Proximal subtotal gastrectomy with esophagogastrostomy

For esophagogastrostomy reconstruction after proximal subtotal gastrectomy, the remnant distal stomach in which the gastroepiploic arcade was preserved was brought up just below the dissociated esophagus for end-to-end anastomosis. Robotic interrupted suturing was performed to fix the distal gastric-remnant and esophagus together. A continuous suture with interlocking of the full layers of the posterior and anterior wall of the esophagus and the stomach was then made (Figure 5). Finally, the anterior wall of the anastomosis was reinforced by interrupted seromuscular sutures.

Total gastrectomy with esophagojejunostomy and Roux-en-Y reconstruction

Fifty-four esophagojejunostomies were performed using methods similar to those described above (Figure 6). After the total stomach was divided, the assistant aids the console surgeon in manipulating the bowel to identify the ligament of Treitz. The small bowel which is 15-20 cm away from the Treitz was brought up just below the dissociated esophagus for antecolic end-to-side anastomosis. Robotic needle holders are loaded with 3-0 absorbable sutures and interrupted suturing is performed to fix the jejunum and esophagus together. Then continuous interlocking suturing is performed between the posterior esophageal wall and seromuscular layer of the jejunum. A 2-3 cm incision is made in the jejunum to be anastomosed. The posterior wall of the esophagus is dissected for the half ring at about 1-2 cm above the cardia. The posterior esophageal and jejunal walls are sutured by a continuous interlocking suture (Figure 6).

Sometimes, especially when the tumor is small or adjacent to the cardia, the tumor cutting edge must be clearly identified. The esophagus is not transected until the posterior wall suturing of the esophagojejunostomy is finished (Figure 6K and L). This strategy can facilitate not only identification of the tumor cutting edge, but also pulling down the esophagus for anastomosis. The remaining half ring of the anterior wall of the esophagus is dissected using an ultrasonic scalpel.

After the anterior wall is clearly exposed, a continuous interlocking suture anterior of the anastomosis wall is performed. Finally, the anterior esophageal wall and anterior seromuscular layer of the jejunum are sutured using interrupted sutures (Figure 6D and E). The proximal jejunum 5 cm away from the esophagojejunal anastomotic stoma, is then transected by the assistant using a 45-mm cartridge endostapler (gold loads, Ethicon Endo-Surgery). The side-to-side jejunojejunostomy and jejunal stump are achieved using the hand-sewn technique in the same manner (Figure 6F-J).

RESULTS

Of the 110 patients enrolled in this trial, two patients could not undergo radical gastrectomy due to late stage disease; 1 patient was converted to laparotomy because of uncontrollable hemorrhage, and 1 obese patient was

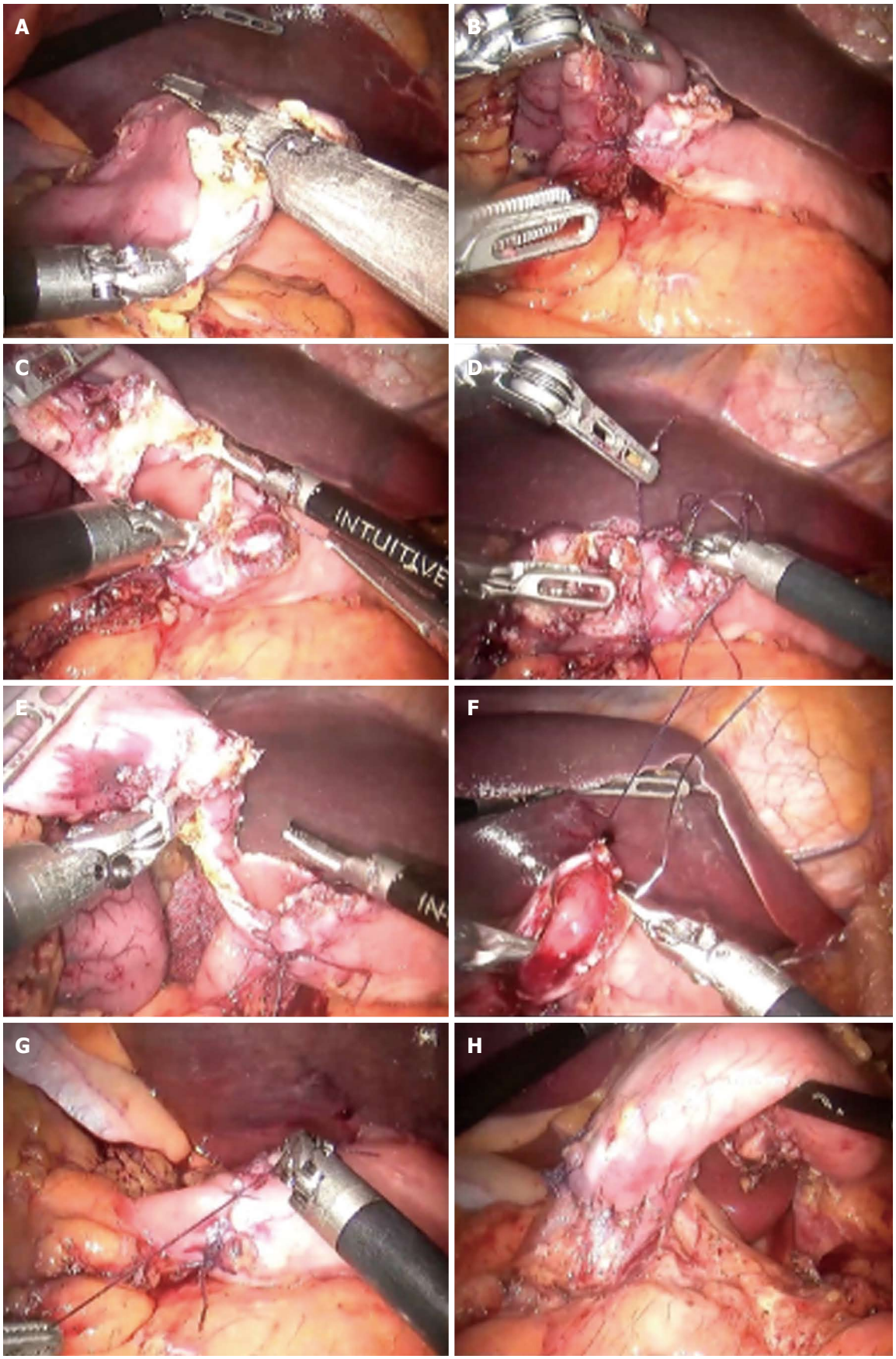

Figure 4 Distal subtotal gastrectomy with gastroduodenostomy (construction type of Billroth Ⅰ). A, B: Robotic anastomosis for gastroduodenostomy; C: Continuous seromuscular suture; D, E: Continuous interlocking suture for posterior wall; F: Continuous interlocking suture for anterior wall; G: Interrupted sero-muscular suture; H: Complete anastomosis.

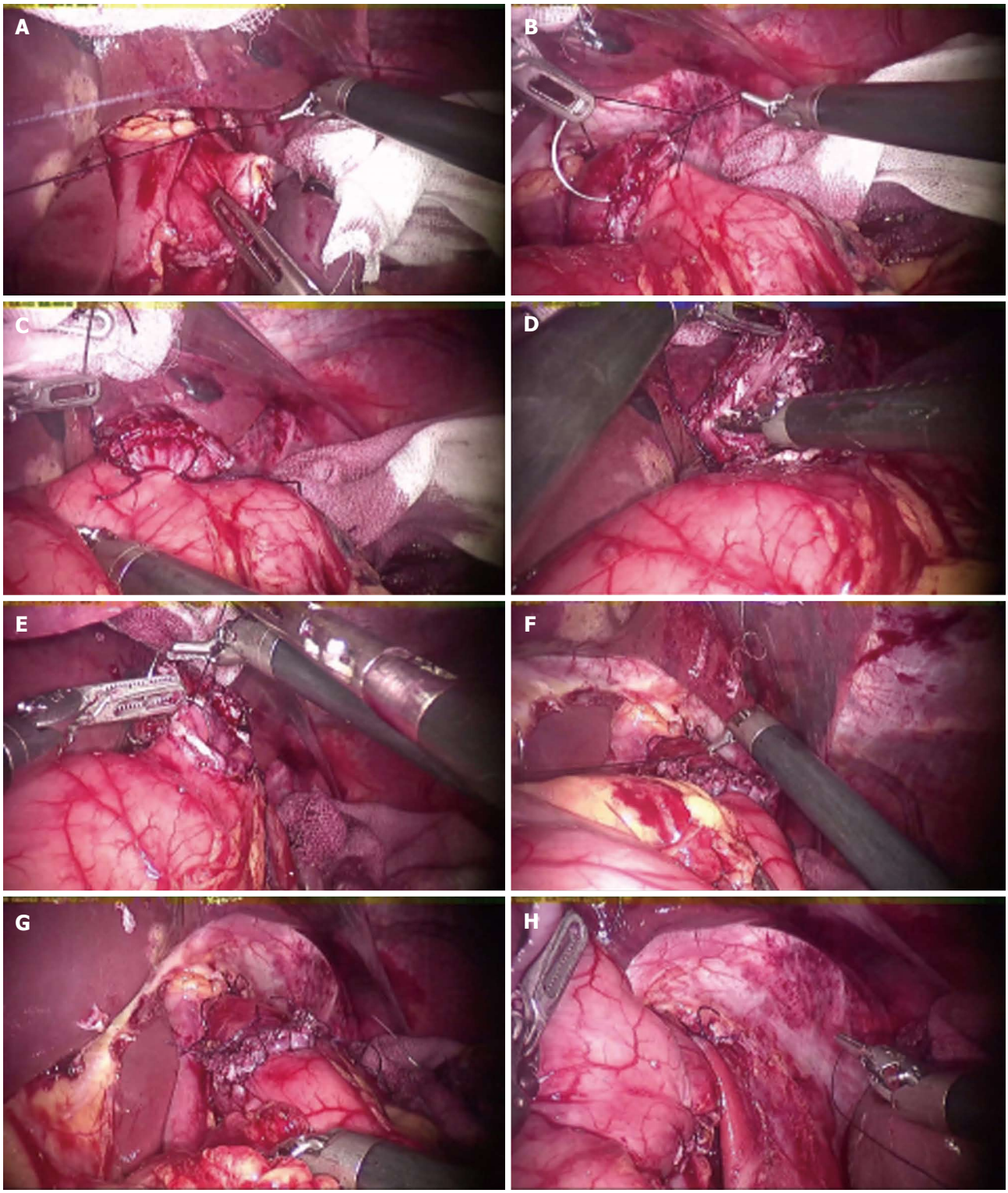

Figure 5 Proximal gastric resection with esophagogastrostomy. A: The terminal esophagus fully mobilized. Diaphragmatic crura are exposed and freed from the surrounding adipose and lymphatic tissue. The esophagus was stitched to the crura for better exposure; B-G: The remnant distal stomach was brought up just below the dissociated esophagus for end-to-end anastomosis; H: Complete anastomosis.

converted due to difficult exposure; 2 patients underwent extra-corporeal anastomosis by minilaparotomy to ensure adequate tumor margin. There were no cases of pancreatic or spleen injury during surgery.

Robot-assisted gastrectomy with total robot-sewn anastomosis were successfully performed in 104 cases, including 66 males and 38 females with an average age of 58.2 ± 12.6 years (range: 40-76 years) and body mass index (BMI) of 22.12 ± 4.64 kg/m^2 (range: 16-26 kg/m^2). Patient characteristics are presented in Table 1.

Fifty-four esophagojejunostomies with Roux-en-Y reconstruction for 54 total gastrectomies, 22 gastroduo-

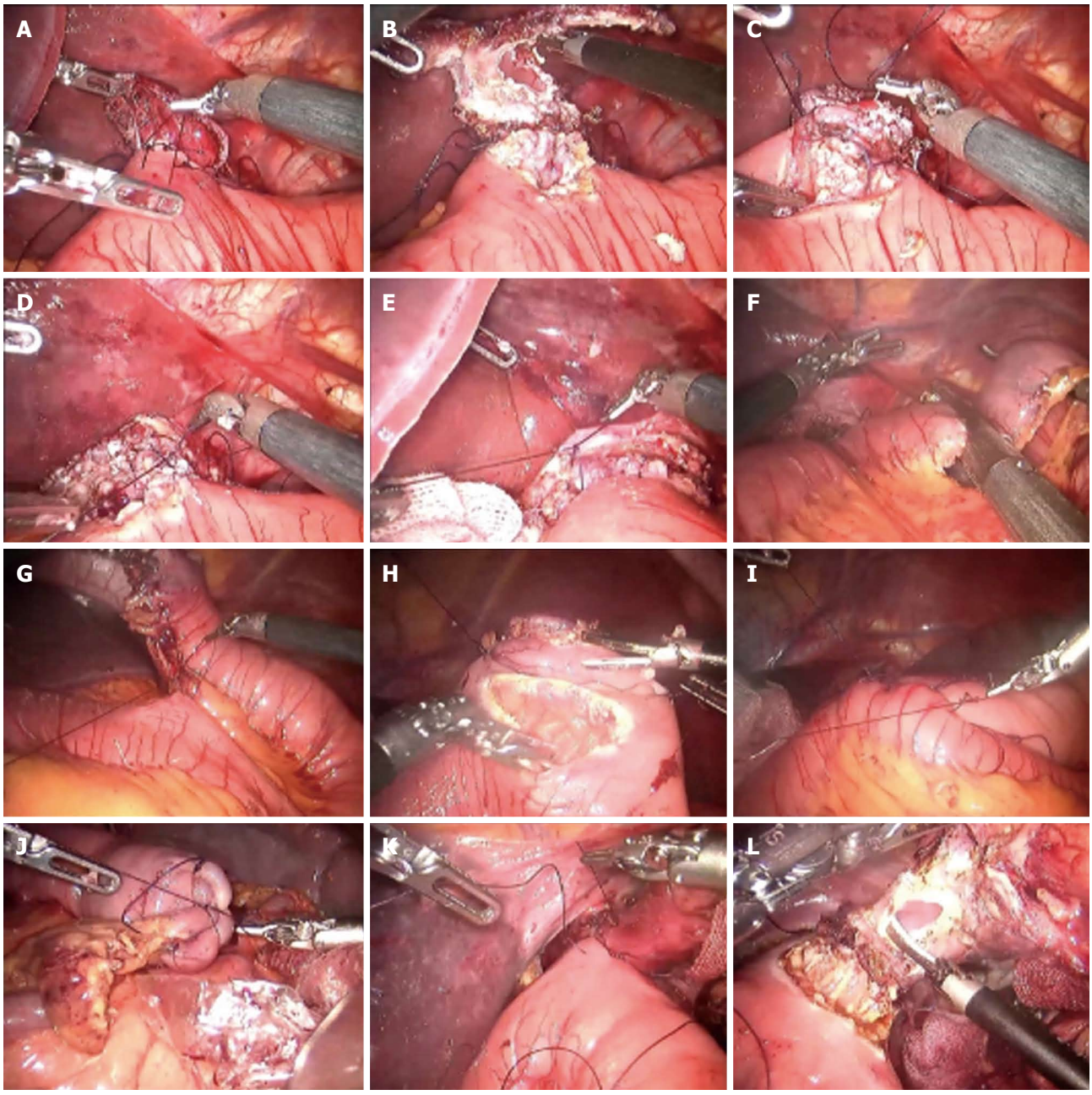

Figure 6 Total gastrectomy with esophagojejunostomy and Roux-en-Y reconstruction. A-E: The small bowel which is 15-20 cm away from the Treitz was brought up just below the dissociated esophagus for antecolic end-to-side anastomosis. Robotic anastomosis for esophagojejunostomy was performed in the same manner; F: The proximal jejunum 5 cm away from the esophagojejunal anastomotic stoma is transected by a 45-mm cartridge endostapler; G-I: The side-to-side jejunojejunostomy and jejunal stump were achieved using the hand-sewn technique in the same manner; J: Jejunal stump was achieved using the hand-sewn technique in the same manner; K, L: Sometimes, the esophagus was not transected until the posterior wall suturing of the esophagojejunostomy was finished.

denostomies and 16 gastrojejunostomies for 38 distal subtotal gastrectomies, and 12 esophagogastromies for 12 proximal subtotal gastrectomies were successfully performed. The average operation time was 272.52 ± 53.91 min, and median reconstruction time was 45.8 ± 26.0 min (Table 2). The average amount of bleeding during surgery was approximately 80.78 ± 32.37 mL. From the pathologic findings, the average number of harvested lymph nodes was 23.1 ± 5.3. No tumor specimens showed positive surgical margins. The final pathological staging was as follows: stage Ⅰ, 26 cases; stage Ⅱ, 32 cases; stage Ⅲ, 46 cases.

The average time to first flatus and semi-liquid diet after surgery was 2.5 ± 0.7 and 4.1 ± 1.3 d, respectively. The average length of postoperative hospital stay was 6.2 d. Postoperative complications were observed in 12 (11.5%) patients and included anastomotic leakage in 1 (0.96%) patient, gastroplegia in 2 (1.9%) patients, prolonged ileus in 2 (1.9%) patients and poor wound healing in 2 (1.9%) patients. Postoperative complications are shown in Table 3. The anastomotic leak was mild and occurred in the duodenal stump. The patient recovered

Table 1 Patient characteristics

Characteristics (n = 104 cases)	
Age (yr, mean ± SD)	58.2 ± 12.6
Gender (male/female)	66:38
BMI (kg/m^2, mean ± SD)	22.12 ± 4.64
ASA status	
Ⅰ	28
Ⅱ	72
Ⅲ	4
Comorbidity	
Diabetes	14
Valvular heart disease	6
Chronic atrial fibrillation	4
Hypertension	26
Occlusive vascular disease	4
Chronic anemia	18
Primary bronchiectasis	2

BMI: Body mass index; ASA: American Society of Anesthesiologists.

Table 2 Intraoperative data and early outcome (mean ± SD)

Type of gastrectomy and anastomosis		
Total esophagojejunostomy with Roux-en-Y reconstruction		54
Distal	Gastroduodenostomy/ gastrojejunostomy	38
Proximal	Esophagogastrostomy	12
TNM staging		
Ⅰ		26
Ⅱ		32
Ⅲ		46
Operative time (min)		
Overall		272.52 ± 53.91
Total gastrectomy		302.5 ± 20.28
Distal subtotal gastrectomy		266.54 ± 35.26
Proximal gastrectomy		264.82 ± 40.33
Construction time (min)		45.8 ± 26.0
Total number of retrieved lymph node		23.1 ± 5.3
Estimated blood loss (mL)		80.78 ± 32.37
Hospital stay after surgery (d)		6.2 ± 2.5

fully following treatment with continuous irrigation drainage for 12 d. One patient underwent re-operation on post-operative day 14 due to jejunal afferent loop obstruction and recovered 10 d later. Another patient who underwent distal gastrectomy with gastroduodenostomy was readmitted due to intra-abdominal infection after surgery. She was treated with abdominal puncture and drainage and recovered.

DISCUSSION

The first robotic cholecystectomy was performed by Cadière *et al*[19]. Currently, robotic surgery is widely applied in most operations. Recent studies have shown that robotic gastrectomy is feasible for patients with gastric cancer[20,21].

A recent trend in minimally invasive surgery for the treatment of gastric cancer has attempted to reduce the length of the skin incision. The fact that minilaparotomy itself can cause traumatic stress to surgical patients led to the development of a totally laparoscopic technique in which all of the surgical procedures, including reconstruction, are performed intraabdominally under a laparoscopic field[22]. Various methods have been established to facilitate intracorporeal anastomosis[23-25]. A recent study in a large volume center showed that extracorporeal anastomosis can be changed to intracorporeal anastomosis using a stapling device. However, this laparoscopic method, especially in esophagojejunal anastomosis, presented many technical problems including exposure difficulty, impossible reinforced suturing, variation in the diameter of the esophagus and a weak point in double stapling[26-28]. Due to the technical difficulties of laparoscopic anastomosis and concern regarding anastomotic complications using the stapling method[29], many surgeons still prefer extracorporeal reconstruction. However, with the advance of robotic surgery, the da Vinci system has become a minimally invasive cutting edge surgical technique. Since articulating instruments of the robotic device may provide complete wrist dexterity, allowing fine control with precision when performing intracorporeal sutures, a robot-sewn anastomosis in robotic gastric cancer surgery could avoid minilaparotomy and additional laparoscopic techniques, and provide surgeons with a reduced risk of anastomotic complications similar to hand sewing[22].

Table 3 Postoperative complications using the Clavien-Dindo classification

Complications	Grade 1	Grade 2	Grade 3a	Grade 3b	Grade 4	Grade 5
Anastomosis leakage	1					
Gastroplegia		2				
Prolonged ileus		2				
Alimentary tract obstruction				1		
Alimentary tract hemorrhage		1				
Poor incision healing			2			
Pulmonary infection		1			1	
Abdominal infection or abscess			1			
Intra-abdominal bleeding		1				
Total	1	7	3	1	1	

Robotic operations improved the time to completion and the quality of choledochojejunostomy compared with laparoscopy in an *ex vivo* bench model, especially for surgeons with less experience with minimally invasive surgery[30]. Compared with standard laparoscopy, robotic assistance significantly improved intracorporeal suturing performance and the safety of novices in the operating room, thus significantly shortening the learning curve[31]. Three dimensional vision allows significant improvements in performance times and error rates for both inexperienced residents and advanced laparoscopic surgeons[32]. Hur *et al*[33] reported 2 cases of successful esophagojejunostomy using the full robot-sewn technique after total gastrectomy with lymph node dissection. The study further confirmed that all types of hand-

sewn anastomoses in gastrectomy, which are performed in the deep and narrow space of the abdominal cavity, were technically feasible[33]. Our study of 104 cases also demonstrated that full robotic hand-sewn anastomosis was technically feasible and safe.

Recent studies have demonstrated that the robotic approach does not provide an advantage over laparoscopy[34-37]. Twenty of the initial robot-assisted gastrectomies had similar results to those for experienced laparoscopically-assisted gastrectomies in one report. Other studies have shown that patients who undergo a robot-assisted gastrectomy have a larger number of dissected lymph nodes and a smaller amount of bleeding during radical surgery for early gastric cancer than those who undergo a laparoscopically-assisted gastrectomy[38,39], but not in terms of hospitalization time after surgery[32]. Some scholars have indicated that one reason for the insufficient demonstration of this surgical system's advantages is that full robot-assisted reconstruction of the alimentary tract[40] was not performed in these studies. Before this clinical trial, we performed more than 100 cases of robot-assisted gastrectomy with minilaparotomy for anastomosis[41]. According to our experience, hospitalization time after robotic surgery with full intracorporeal anastomosis decreased by approximately 1 d compared to that with minilaparotomy for anastomosis. The rate of incision infection was sharply reduced in robotic surgery with full intracorporeal anastomosis. However, to achieve a definite result, a large number of robot-assisted gastrectomy cases and well-designed research are needed. As the number of robot-assisted gastrectomy cases increase, surgical outcomes may improve.

Although this trial showed many benefits in terms of clinical outcomes, limitations were still encountered. As a result of full robotic intracorporeal surgery, the tumor location may not be identified as easily as extra-corporeal anastomosis. Thus, preoperative examination with gastro-endoscopy and computed tomography is obligatory to determine the location of the tumor and the type of gastrectomy. As the specimen was extracted from the abdominal cavity through the extended intraumbilical port site, the stomach was opened to ensure the tumor margin was adequate. As in our study, 2 cases were diagnosed with early stage tumor in the middle part of stomach and the precise location of tumor was not palpable even with 3-D vision during surgery. Thus, these two cases were converted to extra-corporeal anastomosis *via* minilaparotomy to ensure adequate tumor margin.

The optimal method for full intracorporeal anastomosis remains to be established. It is probable that there is not one single optimal method. As we have shown, full robot hand-sewn anastomosis can be safely and rapidly performed by surgeons familiar with intracorporeal suturing and knot-tying techniques. This technique is feasible and can produce satisfying postoperative outcomes, and may be a minimally invasive technique in future gastrectomy surgery.

COMMENTS

Background

To achieve a minimally invasive method in gastrectomy surgery, a minimal gastroenteral anastomosis must be completed intracorporeally. Various modified procedures for reconstruction have been reported, but an optimal method has not been established due to technical difficulties. Robotic surgery has theoretical advantages such as increased degrees of freedom of instruments and a three-dimensional view. The aim of this study was to determine the feasibility and effectiveness of full robot-assisted total gastrectomy using intracorporeal robot hand-sewn anastomosis in the treatment of gastric cancer.

Research frontiers

Hand-sewn suturing is technically demanding, but with the advantages of robotic surgery it can be performed safely by trained surgeons. This technique is feasible and can produce satisfying postoperative outcomes. Its convenience and reliability in anastomosis for gastrectomy were confirmed in the study. This is the first large scale report on full robot-assisted gastrectomy with intracorporeal robot-sewn anastomosis.

Innovations and breakthroughs

The details of the surgical technique were well illustrated in this article. This technique is feasible and can produce satisfying postoperative outcomes, and may be a minimally invasive technique in future gastrectomy surgery.

Applications

Intracorporeal robot-sewn anastomosis can be widely used in robotic surgery centers. It may be a minimally invasive technique in future robotic gastrectomy surgery.

Terminology

Robotic surgery: Computer-assisted surgery and robotically-assisted surgery are terms used for technological developments which use robotic systems to aid surgical procedures. Robotically-assisted surgery was developed to overcome the limitations of minimally invasive surgery and to enhance the capabilities of surgeons performing open surgery. Minilaparotomy: A small abdominal incision for surgical procedures, such as liver biopsy, open transhepatic cholangiography, or alimentary anastomosis to ensure minimal traumatic stress.

Peer review

Authors present their prospective experience with full robotic-assisted gastrectomy. They performed 104 successful operations ranging from distal gastrectomy with intracorporeal gastroduodenotomies or gastrojejunostoies to total gastrectomy with esophagojejunostomy. The average surgical time was 272 min and blood loss was 81 cc. Patients averaged 6.2 d in hospital. The authors conclude that robotic gastrectomy with intracorporeal anastomosis is feasible and safe. Further case-control studies need to be conduct to investigate the advantage of intracorporeal robot's hand sewn anastomosis.

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