

Stapled esophagojejunal anastomoses: particular aspects of minimally invasive surgery and comparison with manual anastomoses – a single team experience*

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Rezumat

Anastomoza esofagojejunală mecanică: aspecte particulare ale abordului minimal invaziv - experiența unei singure echipe chirurgicale

Scopul studiului: Chirurgia reprezintă unica modalitate terapeutică cu eficiență demonstrată în cancerul gastric. De la introducerea sistemelor mecanice de efectuare a anastomozei esofagojejunale au existat studii care să demonstreze superioritatea acestora față de anastomozele manuale.

Metodă: Au fost analizate retrospectiv datele a 88 de pacienți operați în perioada ianuarie 2004 – noiembrie 2011 de către o singură echipă chirurgicală. 14 pacienți au beneficiat de o gastrectomie totală prin abord minimal invaziv și 74 de pacienți de o gastrectomie totală prin abord deschis. S-au efectuat 59 de anastomoze manuale și 29 de anastomoze mecanice.

Rezultate: Nu au existat cazuri de fistulă anastomotică în grupul în care s-a practicat anastomoza mecanică. Au existat 4 cazuri de fistule anastomotice în grupul în care s-a practicat anastomoza manuală. Nu au existat cazuri de mortalitate post-operatorie.

Concluzii: Utilizarea sistemelor de sutură mecanică ca metodă de restabilire a tranzitului intestinal după gastrectomia totală reprezintă un abord sigur cu rezultate superioare comparativ cu anastomozele manuale.

Cuvinte cheie: anastomoza esofagojejunală, gastrectomia totală robotică, gastrectomia totală minimal invazivă, chirurgie robotică

Abstract

Background/Aims: Surgery remains a mainstay of current approaches for the treatment of gastric cancer. Since the introduction of the first mechanical stapling devices, a debate started about whether mechanical staplers or manual suture produce better results.

Methods: 88 patients operated by a single team between January 2004 and November 2011 were included in this study: 14 patients underwent minimally invasive total gastrectomy and 74 patients had an open total gastrectomy. Manual suture anastomoses were performed on 59 patients and stapled anastomoses were done on 29 patients.

Results: There were no cases of anastomotic leakage or stenosis for the stapled group. There were 4 cases of anastomotic leakage in the manually suture group. There were no cases of anastomosis related mortality.

Conclusion: the data support the use of stapled esophagojejunal anastomosis as a safe way to create a esophagojejunal anastomosis, with superior results in term of anastomotic leakage or stenosis to those with hand suturing.

Key words: esophagojejunal anastomoses, robotic total gastrectomy, minimally invasive total gastrectomy, robotic surgery

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Introduction

Surgery remains a mainstay of current approaches for the treatment of gastric cancer, with chemotherapy and chemoradiotherapy being of some value as adjuvant or neoadjuvant treatment (1). Minimally invasive surgery is now a viable alternative (2), and we must investigate which of the available techniques translate into better outcomes (3).

Except for the East Asia region, the majority of gastric cancers are still diagnosed at an advanced stage, when total gastrectomy followed by D2 dissection offers the best prospects in term of overall survival (4). After this type of surgery, the most important complications in terms of post-operative mortality and morbidity are those related to the esophagojejunal anastomosis. Since the introduction of the first mechanical stapling devices (5), a debate started about whether mechanical staplers or manual suture produce better results. This debate continued well into the nineties, when very large studies settled the debate in favor of stapled anastomosis (6).

For laparoscopic surgery, stapled anastomosis is the only viable option, with a choice to be made between linear stapler and circular stapled anastomosis. Robot-assisted surgery can overcome some limitations of laparoscopic surgery and some experienced surgical teams have even come to regard robot sutured anastomoses as a feasible reconstruction method (7). In this context, the comparison of sutured vs. stapled esophagojejunal anastomoses is again important. We support the view that for three possible operating situations: open surgery, minimally invasive surgery with intracorporeal anastomoses and with extracorporeal anastomoses, the comparison must be made separately.

Also, robot-assisted surgery being a new technique, there are important variations to consider regarding operating setup, technical details and choice of surgical technique (8). It is worth investigating which of these can influence outcomes like complication rates and patient recovery time.

Patients and Methods

88 patients operated by a single team between January 2004 and November 2011 were included in this study: 14 patients underwent minimally invasive total gastrectomy (MITG) (one laparoscopic and the others robot-assisted) and 74 patients had an open total gastrectomy (OTG). Manual suture anastomoses

were performed on 59 patients in the OTG group and stapled anastomoses were done on 29 patients (15 patients from the OTG group and 14 patients in the MITG group).

The mean age for the patients with manual sutured anastomoses was 57.82 ± 13.13 , compared with 58.39 ± 15.03 for the patients in the stapler group. There were 44 carcinomas of the middle third of the stomach and 15 of the upper third or cardia in the manually sutured group and 24 carcinomas of the middle third of the stomach and 5 of the upper third or cardia for the stapler anastomosis. This data, further stratified by MITG and OTG, are shown in *Table 1*.

Surgical Procedure

All procedures were performed by a single surgical team at a single institution. Robotic, laparoscopic and open total gastrectomy with D2 lymph node dissection was performed as described elsewhere (9,10). A minor difference in operating setup was the position of the first assistant-surgeon and second assistant-surgeon on the left and right sides of the patient (11).

The reconstruction phase of the operation was similar for the open and minimally invasive surgery, involving an antero-colic Roux-en-Y reconstruction and a termino-lateral esophagojejunal anastomosis. After robotic and laparoscopic total gastrectomy, a vertical midline incision of 4 to 7 cm was made in the epigastrium and the stomach was removed through this minilaparotomy site. Prior to transection of the esophagus, a purse-string suture device was attached to it. After inserting the stapler's anvil head into the esophageal stump, the purse-string was closed. Although the procedure is simple, several precautions are needed. The entire layer of the esophagus must be secured around the anvil head. The esophagus should be dissected 2 or 3 cm proximally to the resection line, and the thread of purse-string should be tied tightly around the esophagus, leaving no slack. The foot of the Roux-en-Y was constructed extracorporeally, after transecting the jejunum 40 cm away from the Treitz angle, by hand-sewing a termino-lateral jejunojejunal anastomosis and reinserting it into the abdomen. Extracorporeal esophagojejunostomy was performed using a 25 mm circular stapler. The stapler was inserted into the free jejunal loop and an end-to-side stapled esophagojejunal anastomosis was made. The jejunal stump was closed with a linear stapler. For some of the stapled anastomosis patients, supplementary sutures (either partial or complete circumferential) were

Table 1. Patients' characteristics

	Manual suture anastomosis (n = 59)	Stapler anastomosis (n = 29)	
	Open Surgery (n = 59)	Open Surgery (n = 15)	Minimally Invasive Surgery (n = 14)
Age (yr, mean \pm S.D.)	57.82 \pm 13.13	59.63 \pm 13.73	55.57 \pm 18.55
Male/Female	34/25	7/8	10/4
Site of carcinoma			
Middle third	44	11	13
Upper third or cardia	15	4	1

Table 2. Surgical procedure results

	Manual suture anastomosis (n = 59)	Stapler anastomosis (n = 29)	
	Open Surgery (n = 59)	Open Surgery (n = 15)	Minimally Invasive Surgery (n = 14)
Palliative procedure	10	4	1
Extended surgical procedure (*)	10	1	0
Splenectomy	14	7	2
Operating time (min)	260±75	250±68	280±60
Blood loss (ml)	250±85	250±85	55±10
Time to soft diet (days)	8±2	4±1	4±1
Hospital stay (days)	9±3	6±2	6±2

(*) Small and/or large bowel resection, pancreatic resection or hepatic resection, except splenectomy

performed. Additional sutures were used to anchor the distal end of the anastomosed esophagus to the diaphragmatic pillars.

The procedure was similar for open surgery except for completing the foot of the Roux-en-Y after the esophagojejunal anastomosis.

Manual anastomosis was performed in a conventional end-to-end two layers with continuous absorbable sutures. A feeding tube was placed in the open surgery patients but not in the robotic and laparoscopic surgery group. Suction drains were positioned close to the duodenal stump and gastrojejunal anastomosis.

Results

Regarding operating time, the largest difference was seen in the OTG vs. the MITG group 260±75 compared to 280±60, with a minimal reduction in operating time for the stapled OTG patients vs. the manually sutured OTG cases (data in Table 2). Average blood loss was 250±85 ml for the OTG group and 55±10 ml for the MITG group. 10 of the 59 manual suture anastomosis procedures and 5 of the 29 stapler anastomoses were palliative. An extended surgical procedure (which we defined as a small and/or large bowel resection, pancreatic resection or hepatic resection, except splenectomy) was performed on 10 patients in the manually sutured group and 1 patient in the stapled group. 23 patients underwent splenectomy, 9 of which were in the stapled anastomosis group. No supradiaphragmatic anastomoses were performed.

There were no cases of anastomotic leakage or anastomotic stenosis for the stapled group. There were 4 cases of anastomotic leakage in the manually suture group, re-operation was required for 2 patients that experienced major leakage while the other 2 have achieved a complete cure with conservative treatment (minor leakage). There was only one case of stenosis, in the manually sutured group. There is a clear difference in the incidence of anastomotic leakage and stenosis in the manually sutured anastomosis group vs. the circular stapler anastomosis group, although this difference is not statistically significant due to the small number of robot-assisted total gastrectomies we performed. We report no cases of anastomosis related mortality (Table 3).

The clinic's extensive experience of over 400 total

gastrectomies allowed us to ensure a high standard of pre and post-operative care for all patients.

Discussion

More than a hundred years from Schlatter's first total gastrectomy (12) and more than 30 years from the first circular stapler anastomoses (5), we are stepping into an era of minimally invasive gastric surgery. This new approach requires us to reassess the advantages and disadvantages of the current surgical methods in order to make an optimal selection of surgical technique. All aspects of the procedure must be properly weighted when making a decision, including outcomes, operating time, recovery time and cost.

A large percent of gastric cancers are diagnosed in late stages and, after (re)analyzing the data from the largest studies in Europe and Japan (13-15), total gastrectomy with D2 dissection and with the spleen and pancreas left in situ is considered to offer the best prospects of survival (4). Of the many possible reconstruction procedures after this type of surgery, the simple Roux-en-Y is preferred by the vast majority of surgeons. The main sources of short term post-operative morbidity and mortality after total gastrectomy were, for a long time, complications directly related to the esophagojejunal anastomosis, mainly anastomotic leakage that can lead to sepsis, and anastomotic stenosis. This is why we focused our attentions on the different techniques for performing esophagojejunostomy with emphasis on the ones suitable for robot-assisted surgery.

After open total gastrectomy, the reported anastomotic leakage for circular stapler esophagojejunal anastomosis in

Table 3. Complications

	Manual suture anastomosis (n = 59)	Stapled anastomosis (n = 29)
Leakage	4	0
Major (required reintervention)	2	0
Minor (conservative treatment)	2	0
Stenosis	1	0

the nineties were around 5% in Japan (National Cancer Center in Tokyo) and similar in European studies (13). A 6.5% overall leakage rate was reported in the Dutch gastric cancer trial, with as high as 9% leakage rate in the D2 dissection group. We are aware though that subgroup analysis performed on the data in this study showed that most of the increase in the rate of complications for the D2 patients was for those who also underwent splenectomy or distal pancreatectomy (15). An interest in comparing manual suture and circular stapler anastomosis has existed since the introduction of the first mechanical stapling devices (16). Studies like the one by Fujimoto et al. (17) tried to show the lack of a significant difference between the two techniques, but the debate continued and some found marginally better outcomes for stapled anastomosis (18). Very large studies, like the one made at Japan's National Cancer Center from 1985 to 1997 showed a decrease in the rate of anastomotic leakage in parallel to the increased usage of the mechanical stapler (from 1995 onwards all anastomoses were made with the stapler)(6). Leakage rates as low as 0.5% for stapled anastomoses are reported (19) and stapled esophagojejunostomy is considered by most to be the best alternative.

An important driving factor for the progress of mechanical esophagojejunostomy was the progress of minimally invasive surgery. In this setting, manual suture is no longer an option. Laparoscopic D2 lymphadenectomy is considered a complex procedure even by experienced minimally-invasive surgeons (20) and laparoscopic sutured anastomosis is not a feasible technique. Robot-assisted surgery can overcome some limitations of traditional laparoscopic surgery, thanks mainly to 3-D magnified vision and articulated instruments. This makes robotic-suture anastomosis a possibility, at least for highly skilled and experienced robotic surgery teams, and some have even reported doing this procedure in less than 300 min total operating time (21). Nevertheless, stapled anastomosis is the most pursued technique in minimally invasive surgery.

There are two main ways of constructing a stapled esophago-jejunal anastomosis following minimally invasive total gastrectomy: intracorporeally and extracorporeally, through a minilaparotomy site. The last approach may take better advantage of the surgeon's previous experience in performing circular stapler esophagojejunostomy after open total gastrectomy. Concerning postoperative complications, the rate of anastomotic leakage is below 2% (22), but there are no studies with a large number of cases so far (all have less than a hundred operated patients). As data from small case number studies like ours accumulates, a meta-analysis may provide some early data on which to base our decision of choosing this technique or not. Our results are in accordance with those of others since we had no anastomosis related postoperative complications after this type of surgery. Another advantage of extracorporeal stapled esophagojejunostomy is that the stapled anastomosis can be supplemented with manual sutures, either partially or circumferential, as an additional safety measure.

The other alternative is to perform intracorporeal esophagojejunostomy, which can be done either

using the circular stapler (23), similarly to the extracorporeal stapled anastomosis, or using the linear stapler and performing a latero-lateral anastomosis (24). Increased operating time seems to be the only drawback for these techniques, but the number of cases operated this way so far is not enough to effectively compare the complications rate with the other techniques.

Conclusion

All-types of laparoscopic or robotic-assisted surgery for gastric cancer offer the advantages of less intraoperative blood loss, a lower complications rate and earlier return to oral diet. Nevertheless, the rates of recurrence and overall mortality remain equivalent to those of open surgery. There is hope though, that a shorter time of recovery from surgery could mean shorter time to adjuvant chemotherapy, which has been shown to improve 5-year survival. Thus, there is a possibility that combined with perioperative chemotherapy, minimally-invasive gastric cancer surgery could even increase patient survival.

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