HOW-I-DO-IT ARTICLE

Totally laparoscopic 95 % gastrectomy for cancer: technical considerations

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Abstract

Introduction Total gastrectomy is the standard treatment for tumours arising in the proximal stomach and for diffuse cancer according to the Lauren classification. Laparoscopic approach is progressively accepted and provides encouraging results. In order to reduce complications associated to the esophago-jejunal anastomosis, the concept of the 95 % open gastrectomy was developed in Japan, in the early 1980s. This procedure provides the spearing of a small remnant gastric stump of 2 cm and allows performing a gastro-jejunal anastomosis. Unlike the 7/8 gastrectomy, the 95 % gastrectomy allows the complete resection of the gastric fundus and an optimized pericardial lymph node dissection (group 1 and 2). We herein describe, step-by-step, our technique of full laparoscopic 95 % gastrectomy (G95 %), with D2 lymphadenectomy, including complete lymphadenectomy of the cardial nodes.

Discussion When it is possible to respect the oncologic criteria regarding proximal resection margin, 95 % gastrectomy would offer best short-term results, such as lower anastomotic leak rate and a better quality of life, limiting the effect of disruption of the eso-gastric junction.

Conclusion In selected patients, laparoscopic G95 % is feasible and safe; it could be performed without any additional technical difficulties. Controlled clinical trials are necessary to confirm the encouraging results of the cases series, recently reported in literature.

Keywords Laparoscopy · Laparoscopic gastrectomy · Total gastrectomy · Near total gastrectomy · 95 % gastrectomy · Distal gastrectomy

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Introduction

Total gastrectomy (TG) is the standard treatment for the tumours arising in the proximal stomach and in all localisations of diffuse type adenocarcinomas, according to Lauren classification (1).

Although the laparoscopic approach is validated for the treatment of the early gastric cancer (EGC), some authors have expanded the indications to the advanced gastric cancer (AGC), confirming the benefits of the less invasive approach in the short-term, without compromising the oncological prognosis of patients (2–8).

However, the leakage rate of esophago-jejunal anastomosis (EJA) remains high, with prevalence between 5 and 17 % out of all TG for cancer, considering both open and laparoscopic approaches (9–11).

In order to reduce the complications associated to the EJA, the concept of a near-total gastrectomy was developed in the early 1980s (12–14).

This technique provides the resection of approximately 95 % of the stomach, preserving a small gastric stump of 2 cm. It allows the performing of a gastro-jejunal anastomosis,

instead of an EJA, thus reducing the anastomotic leak rate (14–16).

Unlike the 7/8 gastrectomy, the 95 % gastrectomy (G95 %) provides a complete resection of the gastric fundus and a complete dissection of lymph node stations 1 and 2 (Fig. 1).

In order to improve the benefit of laparoscopy, our team adopted the principles of G95 %, modifying the technique of the standard full laparoscopic TG, which we have been performing since 1993 (1).

We herein describe our technique of full laparoscopic G95 %, with D2 lymphadenectomy, including complete lymphadenectomy of the cardial nodes (Fig. 1), the same as it has been previously described for the full laparoscopic TG (17, 18).

Operative technique

Trocar positioning

The patient is placed in a slight Trendelenburg position with legs apart (Fig. 2). The surgeon is placed between the patient's legs, with an assistant on each side. Five trocars are placed in an arch around a sixth trocar, which is placed under the xyphoid.

A 0° telescope is placed through the supra-umbilical port for the mid-abdominal dissection and then through the epigastric port for the upper abdominal dissection (Fig. 3).

Perigastric lymphadenectomy

After conducting a complete exploration of the abdominal cavity and of the liver surface, the procedure begins with the section of the gastro-colic ligament, 3–4 cm above the gastro-epiploic vessels, in order to achieve a complete lymphadenectomy of the 4d, 4sb and 4sa lymph node stations (Fig. 4(1)). The access to the lesser cavity is then achieved. The dissection of the adhesions of the posterior aspect of the stomach with the

pancreatic capsula allows the mobilization of the antral region of the stomach. A firm grasp on the posterior gastric wall allows the antrum to be toppled upwards.

The gastro-epiploic vessels are divided between clips at their origin, as close as possible to Henle's trunk and gastroduodenal artery (dissection of the sixth lymph node station). The section of the gastro-epiploic pedicle allows correct exposure of the posterior aspect of the pylorus, and thus, we are able to obtain the retro-duodenal tunnel (Fig. 4(2–4)). The gastroduodenal artery remains in place and it is dissected upward towards the hepatic artery.

The junction between the pars-condensa and the pars-flaccida of the hepato-duodenal ligament is opened, reaching the retro-duodenal dissection (Fig. 4(5)). The right gastric artery is followed and sectioned at its origin from the hepatic artery during the dissection of the fifth lymph node station (Fig. 4(6)). The duodenal bulb, fully dissected, is transected, 2 cm distally to the pylorus, with a 60-mm Echelon Flex® linear stapler (Ethicon Endo-Surgery, Cincinnati, OH, USA) with a blue cartridge of 1.5 mm (Fig. 4(7–8)).

The dissection of the pars flaccida of the lesser omentum continues, as close as possible to the liver, until reaching the right diaphragmatic pillar, where the right paracardial lymph node station (group 1) is dissected.

Lymphadenectomy of the hepatic artery and celiac trunk

The stomach is then tilted to the left in order to expose the hepatic pedicle. The proper hepatic artery is surrounded by a vessel loop used as a non-traumatic retractor (Fig. 4(9–10)). The lymphadenectomy of the hepatic artery (lymph node stations 8a and 8p) is completed with the cranial dissection of the 12a group (Fig. 4: 10–11). The lymph node package thus obtained (8a, 8p and 12a) is tilted medially and the vascular dissection is continued proximally to reach the 9 and the 11p lymph node stations (Fig. 4(12)). The left gastric artery is dissected and sectioned at its origin between clips. The dissection of the seventh group is completed with the section of
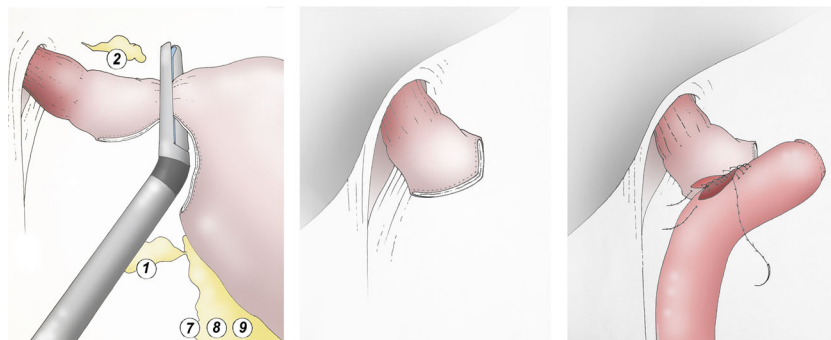

Fig. 1 Schematic representation of the gastro-jejunal anastomosis during the G95 %

Fig. 2 Installation of the patient

the left gastric vein, using a Hem-o-lok® Ligation System (Teleflex®, USA) (Fig. 4(13–16)).

Paracardial lymphadenectomy

The dissection continues cranially along the left diaphragmatic pillar, and the second lymph node station is reached, first through a posterior approach and then anteriorly during the dissection of the angle of Hiss.

The right paracardial lymph node station (group 1) was previously removed during the dissection of the pars flaccida of the lesser omentum (Fig. 4(19)).

Unlike what is usually done in the TG procedure, the anterior aspect of the phrenoesophageal membrane is not opened and the distal esophagus is not dissected, in order to spear the vascularization of the gastroesophageal junction (Fig. 4(20)). The arterial supply to the cardia can originate from the esophageal branches of the left gastric artery or from the left inferior diaphragmatic artery (as is shown in the Fig. 4(20)) or both of phrenic and gastric artery.

Gastric section

After the section of the gastro-splenic vessels, the stomach is transected from right to left, 2 cm below the *cardia* using an
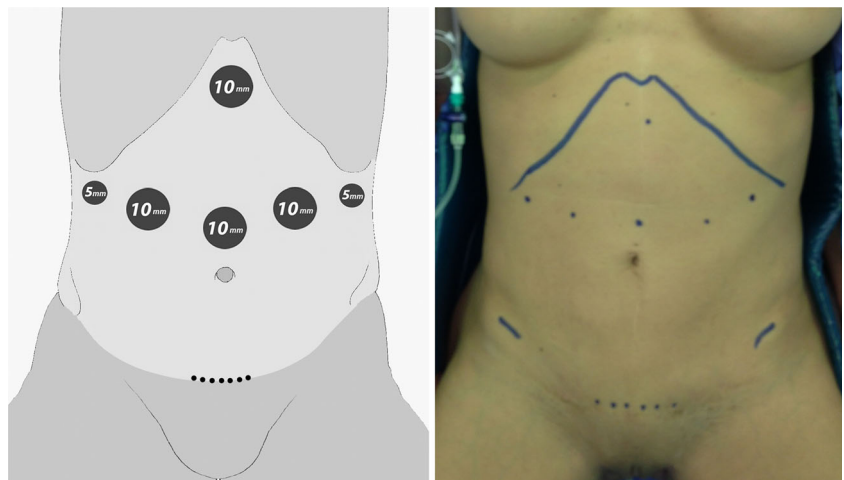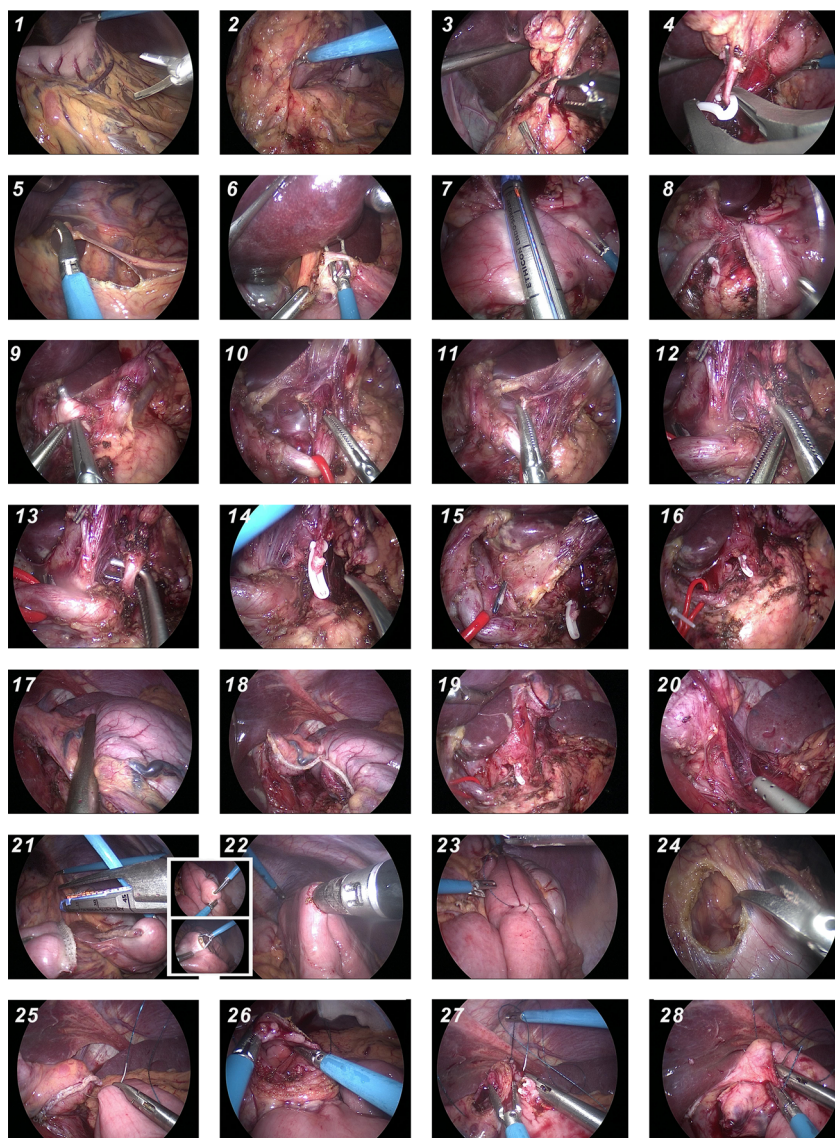
Fig. 3 Trocars' positioning

Fig. 4 Systematic phases of the procedure

Echelon Flex® (Ethicon Endo-Surgery, Cincinnati, OH, USA) linear stapler with a 1.5-mm blue cartridge (Fig. 4(17–18)). A second longitudinal stapling line parallel to the lesser curvature could be calibrated with the help of a 34F gastric tube, drawing a small gastric pouch, about 2-cm high and 3-cm wide (Fig. 4(19–20)).

Omentectomy

In the absence of peritoneal carcinomatosis, no factual evidence exists concerning the modality and the extension of omentectomy. However, total omentectomy is widely associated to a gastrectomy with D2 lymphadenectomy for cancer even though partial omentectomy seems to have encouraging preoperative and postoperative results in patients with EGC (19–21).

At the moment, our team carries out a total omentectomy after the gastrectomy, because of the lack of evidence concerning the benefit of a partial omentectomy, in patients with AGC.

Roux-en-Y jejunal limb

The restoration of intestinal continuity is conventionally performed through a "Roux-en-Y" jejunal limb. The alimentary loop is chosen at the point where there is minimal mesenteric traction: between 20 and 40 cm distal to the ligament of Treitz. The section is done using an Echelon Flex® (Ethicon Endo-Surgery, Cincinnati, OH, USA) linear stapler with a 1.5-mm blue cartridge (Fig. 4(21)). The jejunal mesentery is partially divided for about 3 to 4 cm to facilitate the ascent of the alimentary loop without traction on the mesentery. The jejuno-jejunal anastomosis at the base of the 60-cm alimentary

loop is a wide and side-to-side mechanical anastomosis, with an Echelon Flex® (Ethicon Endo-Surgery, Cincinnati, OH, USA) linear stapler with a 1.5-mm blue charger (Fig. 4(21–23)).

The enteral defect is then closed with a running suture using a barbed self-locking V-Loc ® suture (Covidien, USA) (Fig. 4(22)). This anastomosis can be performed after gastrointestinal anastomosis, depending on the preferences.

The transmesocolic crossing

The transverse mesocolon is opened 1 cm above the ligament of Treitz, in its thinnest region (Fig. 4(24)). The alimentary loop is ascended approximately 15 cm. The mesocolic orifice can be closed using a continuous running suture, including the ascended loop, with non-reabsorbable material.

Gastrointestinal anastomosis

The gastro-jejunal anastomosis is a manual end-to-side anastomosis using a knotless triple running suture with 3/0 V-Loc® (Covidien, USA). We perform two posterior and one anterior sutures (Fig. 4(23)). The assistant on the right side holds the jejunal loop by gentle traction towards the left upper quadrant. The first posterior suture includes all sero-muscular layers, both on the jejunal and the gastric side. The stapling line is included in this running suture. The use of a self-locking suture facilitates exposure (22, 23) and does not require a constant traction by the assistant (Fig. 4(25)).

The small intestine is opened above the first suture and the mucosa can be cauterized for haemostasis. The stomach is opened in the same way, with the help of the pressure induced by the gastric tube. After this step, the gastric tube is completely removed (Fig. 4(26)). A second continuous running suture with 3/0 V-Loc® (Covidien, USA) is then carried out to strengthen the posterior plane, to improve haemostasis on the mucosa and to bury the protruding mucosa (Fig. 4(27)). The suture is tightened with the help of the assistant on the right side of the operator to expose the margins of the two digestive segments.

The anterior running suture of this anastomosis is also done with the same V-Loc self-locking system. The suture is started from the left, in contact with the first point of the posterior suture taking large extramucosal steps on the jejunal mucosa and loading the entire wall of the stomach on the gastric side of the suture (Fig. 4(28)). The left grasper of the surgeon is placed in the stomach to keep it open during the needle passages through the gastric wall.

Drainage

A retro-anastomotic Penrose drain is placed and the specimen is extracted through a small Pfannenstiel incision. A radiologic study is routinely performed at the seventh post-operative day (Fig. 5).

Discussion

Laparoscopic gastrectomy is a feasible and reproducible technique for locally advanced gastric cancer. Its advantages are the usual ones of the laparoscopic approach (improved post-operative recovery, avoiding unnecessary laparotomy, fewer wall complications) without compromising the oncological standards (2, 24, 25).

Since the first description of the full laparoscopic gastrectomy for gastric cancer, in 1993 (1), additional technical modifications have been developed.

The major controversies regard eso-jejunal anastomosis, especially regarding its high prevalence of anastomotic leak (AL) rate: between 5 and 17 %, out of all TG for cancer (9–11, 26).

Furthermore, TG may result in post-operative complications such as heartburn, dysphagia, bitter taste and regurgitation, which suggest the presence of reflux esophagitis due to disruption of the gastroesophageal junction (27, 28).

Fig. 5 Contrast X-ray study at the seventh post-operative day
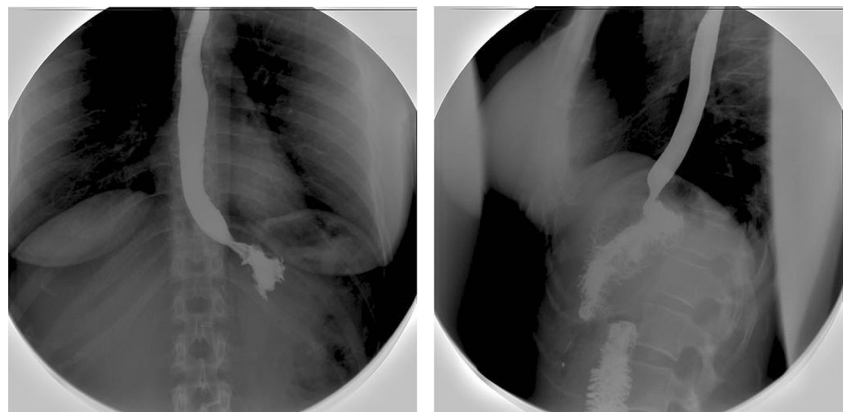
On the other hand, distal gastrectomy (DG), usually indicated in cancers of the distal third of the stomach, is associated with a significantly lower rate of anastomotic leak and better outcomes, at short- and long-term (5).

Thus, DG should be performed when it is possible to achieve the current oncological adequacy, regarding the proximal surgical margins (5).

In this regard, the distance between the proximal gastric section and the upper pole of the tumour remains on a controversial debate. Currently, most of the authors consider 5 cm as a safety distance from the proximal pole of the tumour, in the cases of AGC, and 3 cm for EGC (10, 29–32).

Respecting those conditions, in the current practice, the opportunity to choose a DG is frequently compromised, and a TG is often mandatory. This is particularly true in the Western countries where AGC is more frequent than EGC.

The recent cases series, reported by Jiang and Kim, shows encouraging results of G95 %, which permit to spread a small gastric stump, even when DG is not feasible for the impossibility to respect the adequate oncological margins. Those preliminary experiences with the laparoscopic approach were made with population affected by EGC. More ancient reports describe the open G95 %, performed in a wide panel of indications such as early gastric cancers that have widely spreading, single or multiple lesions, curative or palliative resection of selected patients with advanced gastric cancer and post-vagotomy syndrome (12–16, 33).

Currently, according to the data available in the literature, the oncological indications for the G95 % are very rigorous and may include selected cases of AGC: only in case of intestinal-type neoplasm, according with the Lauren classification, and when it is possible to achieve a margin of more than 5 cm between the proximal gastric section and the upper pole of the tumour. In case of EGC, this margin could be reduced at 3 cm. The negative margins should be verified by the examination of proximal margin frozen section (29, 30).

G95 % could also be employed in palliative resections, severe post-vagotomy syndrome or multi-organ resections for non-gastric neoplasm invading the proximal stomach (12–16, 33).

In all the reported series, G95 % provides an AL rate, estimated to be between 0 and 5 % (12–16, 33).

This lower AL rate could be explicated by the minimisation of the dissection of the gastroesophageal junction respecting the vascular supply of the cardia and providing a gastro-jejunal anastomosis instead of an eso-jejunal anastomosis.

Unfortunately, it is impossible to compare the AL rate of TG and G95 % in terms of evidence-based medicine, because literature lacks in adequate controlled trials and nowadays, just some case series are available.

Conclusion

In selected patients, while respecting the actual oncologic criteria regarding proximal resection margins, laparoscopic G95 % could offer the best short-term results in terms of anastomosis-related complications and early post-operative course, without any additional technical difficulties.

Controlled clinical trials are necessary to confirm that the laparoscopic approach could emphasize the minimal invasiveness of this surgical procedure, without affecting the long-term oncological outcome.

Conflicts of interest   None.

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