

Review Article

Choice of digestive tract reconstructive procedure following total gastrectomy: A critical reappraisal

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INTRODUCTION

Total gastrectomy results in permanent loss of secretory, mechanical and storage functions of the stomach. The altered physiology can be understood from Figure 1. The rationale behind reconstruction after total gastrectomy is to prevent or minimize these post-gastrectomy disorders. More than 70 types of reconstructive procedures have been tried to minimize post-gastrectomy symptoms. Such a large number suggests that an optimal procedure of reconstruction following total gastrectomy has not been clearly established. This article reviews studies addressing the

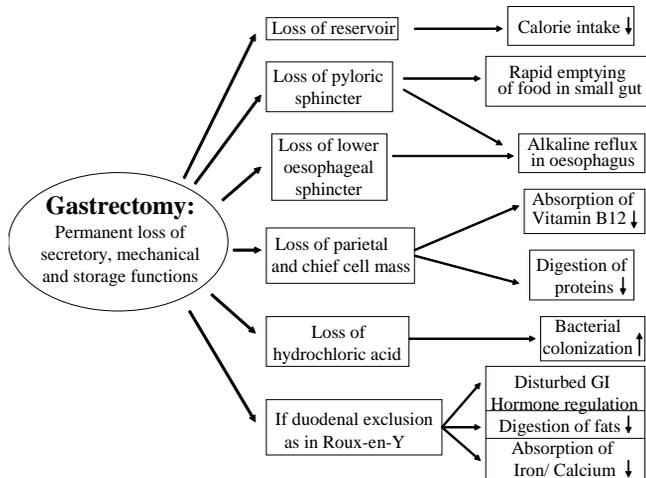


Figure 1: Pathophysiology of post-gastrectomy syndromes

crucial and contentious issue of gastrointestinal reconstruction following total gastrectomy. PubMed and manual search of published articles were used to search for these studies.

IDEAL RECONSTRUCTION AFTER TOTAL GASTRECTOMY

An ideal reconstruction after total gastrectomy should have the following qualities:

1. Should ensure that the patient has a sufficiently large enteric reservoir to accommodate normal meals.
2. Gradual emptying of reservoir into the small intestine.
3. Avoidance of reflux oesophagitis.
4. Maintenance of duodenal continuity, if possible.
5. Operative procedures should not be time-consuming and complicated.

Basically, digestive tract reconstruction following total gastrectomy can be classified into two types according to whether the duodenal tract is excluded or preserved (Figure 2). In principle, pouch procedures for the formation of a neo-stomach were developed to provide a reservoir for food, while the aim behind preservation of the duodenal passage is to restore the anatomy and physiology of the digestive tract. The merits and demerits of these procedures continue to be hotly debated, as results from different studies are contradictory.

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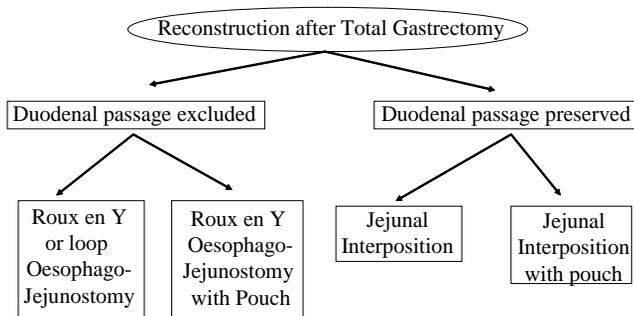


Figure 2: Classification of reconstructive procedures after total gastrectomy

HISTORICAL ASPECT

Professor Carl Nicoladonia of Innsbruck, Austria is supposed to have performed the first total gastrectomy in man but no exact reference to this historical incidence can be found.¹ Conner of Cincinnati performed the first recorded total gastrectomy in 1884, but the patient did not survive the surgery. Finally, the credit for performing the first successful total gastrectomy went to Swiss surgeon Schlatter, who restored the gastrointestinal continuity with an end-to-side oesophagojejunostomy in 1897.² Gastric resectional surgery, since those days, has come a long way. Better anaesthesia, understanding of asepsis, earlier diagnosis and technical know-how has established total gastrectomy as an accepted and safe procedure. Along with this came the understanding of post-gastrectomy nutritional problems and their impact on the quality of life.^{3,4} This led to various surgical procedures being devised to create a larger reservoir for food, to provide a barrier against intestinoesophageal reflux, and to lengthen the food transit time. Historical evolution of the philosophy of reconstruction following total gastrectomy has been chronicled and should be of interest to the connoisseurs.^{3,5-8}

COMPARISON OF DIFFERENT RECONSTRUCTION METHODS

Scientific assessment of post-gastrectomy reconstructed patient is not easy. Anthropometric data, food intake, serum nutritional parameters, haematological survey, small intestinal passage (oral-caecal transit time using lactulose H₂ breath test), postprandial symptoms, dumping provocation tests, lipid and carbohydrate absorption, tests for malabsorption and bacterial overgrowth, blood glucose, insulin, cholecystikinin, motilin, secretin, pancreatic polypeptide measurement after stimulation

by test meals, body weight and quality of life (QOL) have been used to assess these patients and respective reconstructive methods. QOL includes general and specific physical complaints, satisfaction with life, as well as psychosocial burden. As expected, measurement of QOL has seen the use of varied instruments and scales by different authors; commonly used scales were Visick, Karnofsky, Spitzer's QOL index, Cuschieri's assessment, Gastrointestinal Quality of Life Index and EORTC questionnaires.

The most remarkable and striking observation after going through the various studies comparing different operative procedures is lack of consensus about which is the best and optimum procedure. Many randomised clinical trials, and experimental studies have been performed comparing different operative procedures and published in the last two decades but have arrived at different conclusions (Table 1).⁹⁻⁴⁰

EXCLUSION OF DUODENAL PASSAGE

The popularity and preferred usage of this technique could be attributed to its simplicity as it uses minimum number of anastomoses, diversion of bile from the oesophagus is an added advantage. However, its critics mention the altered physiology of duodenal bypass as the main disadvantage leading to bacterial overgrowth and steatorrhea. The simple loop oesophagojejunostomy (Figure 3A) with a distal jejunostomy achieves the same functional result as a Roux-en-Y oesophagojejunostomy (Figure 3B).⁴¹ The former is, perhaps, safer as its blood supply is less likely to be jeopardized, but no prospective clinical trial has been performed to compare the two procedures. The Roux-en-Y procedure when used, has the Roux syndrome as its other disadvantage due to functional dysmotility of the Roux limb.^{42,43} Fortunately, dysmotility of the Roux limb is seen in 10-30% cases and severe forms are even less frequent. Pouch procedures like Hunt-Lawrence pouch are used with Roux-en-Y procedure (Figure 3C) to augment the neogastrium's reservoir capacity and to slow down the rapid emptying of food in the small gut, as both functions are important.^{44,45} It has been shown that food transit through the pouch follows a linear decreasing function and is significantly slower compared to the exponential passage of oesophagojejunostomy, although both patterns remain still significantly accelerated compared to the physiological ranges of gastric emptying.^{16,46,47} One must realize that some altered motility occurs after a Hunt-Lawrence pouch reconstruction even in asymptomatic patients, which may assume

pathological proportions in symptomatic patients.⁴⁸

When the Roux-en-Y pouch procedures were compared with simple Roux-en-Y oesophagojejunostomy, most studies found that patients with pouch reconstruction fared better but significant benefit was not demonstrated in some studies (Table 1). However, research workers have recently realized that beneficial effects of pouch become apparent after a considerable period of time and a real assessment of its benefit must be done after a long follow-up.^{40,49,50} Now pouch formation is being recommended for patients with severe post-gastrectomy symptoms, with no other plausible explanation than non-existent or insufficient gastric reservoir function, in the hope that they may benefit from re-reconstruction with a jejunal pouch.⁵¹

It must be emphasized that the pouch formation adds more suture lines, time and complexities to an already major operation and chances of leakage are, at least, theoretically increased.²⁷

A randomized controlled trial has shown that a short pouch is more effective than a long pouch in maintaining nutrition and in preventing reflux symptoms.^{24,52}

Encouraged by the good outcome after Roux-en-Y pouch procedure several modifications of the Hunt-Lawrence pouch were introduced; notable among these are Lygidakis's modification,⁷ aboral pouch (15-cm long side to side antiperistaltic pouch at the Y anastomosis of Roux-en-Y, Figure 3D)^{35,36,53} or a double pouch (one at the site of oesophagojejunostomy and another at the site of Y anastomosis of Roux-en-Y, Figure 3E).⁵⁴

PRESERVATION OF THE DUODENAL PASSAGE

Interposition of the jejunal loop between the oesophagus and the duodenum restores the duodenal continuity, which maximizes absorption and helps in restoring nutrition. Another obvious advantage is endoscopic accessibility of the duodenum and the bilio-pancreatic system. This procedure was first reported by Henley and later by Longmire (Figure 3F).^{55,56} Although Poth published the first use of jejunal interposed pouch, credit for popularising the jejunal pouch interposition goes to Cuschieri (Figure 3G).^{41,57} There is no doubt that interposition procedures are technically more demanding and complex than those using exclusion of the duodenal passage.

Although preservation of the duodenal passage is the more physiological approach to the restoration of the continuity of the digestive tract, surprisingly, the expected impact of the duodenal passage on symptoms, nutrition and outcome could not be ascertained by most of the studies; thereby negating the additional operative effort of jejunum interposition (Table 1). Two randomized control trials have compared the outcome after jejunal interposition and after jejunal interposition with pouch formation; statistically proven benefits for pouch reconstruction could not be demonstrated by either study (Table 1). Perhaps, the reason for failure of the physiological superiority of the preservation of the duodenal passage not getting translated into clinical benefit lies in denervation of the jejunal interposition. This has given rise to using enervated jejunal loop for reconstruction.^{58,59} Similarly, pylorus, pyloric branch of the vagus nerve and lower oesophageal sphincter are being saved in modified surgical procedures ("nearly total gastrectomy" or

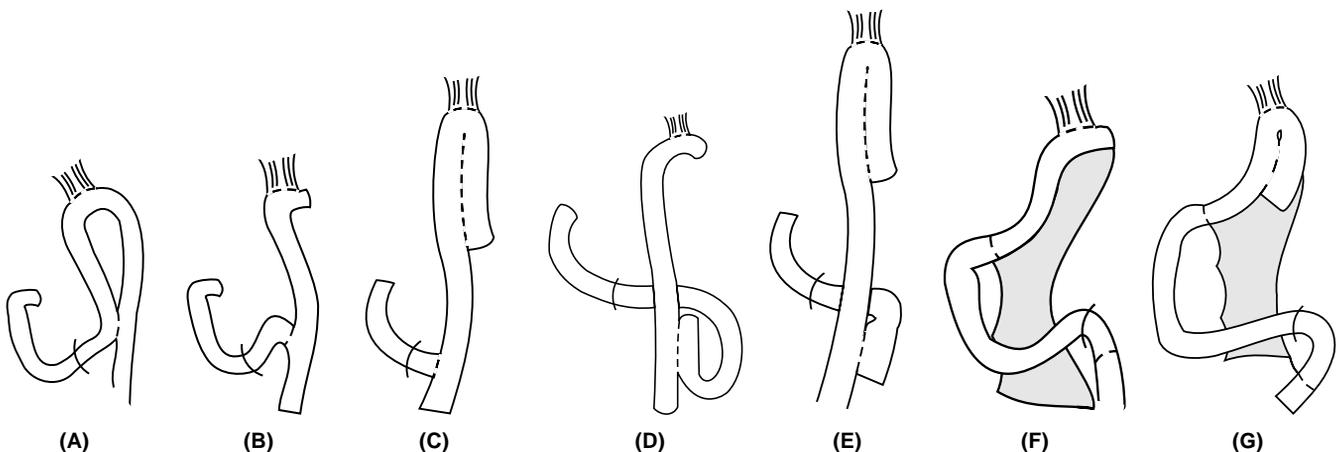


Figure 3: Various reconstructive procedures after total gastrectomy

Table 1: Summary of important studies comparing different techniques of reconstruction after total gastrectomy

First Author	Year of Publication	Publication Type	Compression of	Conclusion
Basso ⁹	1985	RCT	JI Vs RY	No difference
Raab ¹⁰	1987	RCT	JI Vs RY	No difference
Troidl ¹¹	1987	RCT	RY Vs RYP	RYP is better
Miholic ¹²	1990	-	JI Vs RY	JI is better
Miholic ¹³	1991	-	JI Vs RY	JI is better
Roder ¹⁴	1992	-	RY Vs RYP	RYP is better
Schmitz ¹⁵	1994	RCT	JI Vs JIP	No difference* JIP is better*
Stier ¹⁶	1994	-	RY Vs RYP	RYP is better
de Almeida ¹⁷	1994	CT	RY Vs JI	No difference
Beese ¹⁸	1994	Animal Exp	RY Vs RYP Vs JI Vs JIP	RYP is better JI better JIP best
Nakane ¹⁹	1995	RCT	JIP Vs RYP Vs RY	RYP is better No difference
Fuchs ²⁰	1995	RCT	JIP Vs RYP	No difference
Bozzetti ²¹	1996	RCT	RY Vs RYP	No difference
Schwarz ²²	1996	RCT	JIP Vs RYP/ RY	JIP best if survival > 6 months
Liedman ²³	1996	RCT	RY Vs RYP	No difference
Tanaka ²⁴	1997	RCT	JIP Long pouch Vs short pouch	Short pouch better
Schwarz ²⁵	1998	MA	-	More studies needed
Espat ²⁶	1998	Review	-	Optimal method not established
Chua ²⁷	1998	CT	RY Vs RYP	No difference
Iivonen ²⁸	1998	RCT	RY Vs RYP	No difference
Zilling ²⁹	1998	Animal Exp	RY Vs RYP Vs JI	No difference No difference
Kodama ³⁰	1998	-	RY Vs JI	No difference
Schwarz ³¹	1999	Review	JIP Vs RYP Vs RY	JIP if cure likely RYP if cure not likely RY if high risk/ITAn
Liedman ³²	1999	Review	-	Pouch helps in nutrition
Fujiwara ³³	2000	RCT	Types of pouches	J pouch better
Kodera ³⁴	2001	CT	Colon Interposition Vs JI	No difference
Horvath ³⁵	2001	RCT	AP Vs RY	AP better
Kalmar ³⁶	2001	RCT	AP Vs RY	AP better
Fein ³⁷	2001	RCT	RY Vs RYP	RYP better
		Animal Exp	JI / JIP Vs RYP	RYP better
Blochle ³⁸	2001	Review	RYP Vs JI	No difference
Nakane ³⁹	2001	RCT	RYP Vs JIP	No difference
Hokscha ⁴⁰	2002	RCT	JI Vs JIP	No difference

JI = Jejunal Interposition, RY = Roux-en-Y, RYP = Roux-en-Y with pouch, JI P = Jejunal Interposition with Pouch, ITAn = Intra-Thoracic Anastomosis, AP = Aboral Pouch, CT = Controlled Trial, RCT = Randomized Controlled Trial, MA = Meta Analysis, Animal Exp = Animal Experiment, * = Using different methods of Assessment of Quality of Life

“function-preserving gastrectomy”), wherever oncologically feasible, in an attempt to improve motility of the reconstructed digestive tract.⁶⁰⁻⁶⁴

USE OF COLON FOR GASTRIC REPLACEMENT

Use of colon for gastric replacement, as an operative procedure is not new.^{65,66} A segment of left colon has been used and an attempt has been made to recreate

Angle of ‘His’ to prevent reflux with satisfactory results.⁶⁷ But the use of a segment of transverse colon as a gastric substitute after total gastrectomy failed to show any advantage over those treated by the jejunal interposition.³⁴ Recently, ileocolon has been used as an intestinal reservoir combined with an anti-reflux mechanism (caecum as reservoir and the ileocecal valve as substitute for pyloric sphincter). The technique seems to reduce the occurrence of postoperative reflux and dumping symptoms.^{68,69}

HAND-SEWN OR STAPLED ANASTOMOSES?

Randomized controlled trials have shown that operating time, incidence of anastomotic leakage and stenosis, morbidity and hospital stay did not differ significantly between the groups of patients undergoing hand-sewn and mechanically stapled oesophagojejunostomy anastomoses.^{70,71} However, over the years staplers have become quite popular leading to several studies publishing technical refinements for performing oesophagojejunostomy anastomoses and pouch constructions.^{27,43,72-77}

IS IT WORTHWHILE SAVING PART OF STOMACH I. E. AS IN PARTIAL GASTRECTOMY?

Clinicians now realize that malnutrition is not an inevitable consequence of total gastrectomy and can be prevented by an adequate calorie intake, as a close relationship between dietary intake and postoperative nutritional parameters has been observed. In gastrectomized patients a strict nutritional follow-up can ensure an adequate dietary intake.⁷⁸ With few exceptions, most authors agree that maintenance of nutritional status and quality of life is similar after partial/subtotal and total gastrectomy, hence total gastrectomy, when clinically indicated, can be safely done without excessive concern about postoperative nutrition.⁷⁹⁻⁸¹ A randomized controlled trial has shown that patients who undergo subtotal gastrectomy have a better outcome during the first postoperative year, but patients given a gastric substitute after gastrectomy improve with the passage of time and have an even better outcome in the long run.⁸²

WHICH RECONSTRUCTIVE PROCEDURE SHOULD BE USED?

It is not easy to form an opinion on this subject as a review of the literature gives conflicting and confusing guidance (Table 1). There are a few 'bird's eye view' reviews and an occasional meta-analysis which shed some light on this vexing question but an optimal procedure for all clinical situations has not been clearly established. However, one conclusion can be drawn: the choice of the procedure to be adopted depends on the key issue of chances of curability of the gastrectomy.²⁵ This rules out most of the patients being operated in India and other developing countries from being reconstructed with elaborate, complex, time-consuming techniques as late diagnoses of carcinoma stomach is the norm rather than the exception. Logic

dictates that in high-risk patients (on account of the shorter operating time) or if the patient is not likely to survive even 6 months, the least demanding procedure of all i.e. Roux-en-Y-reconstruction without pouch should be done. Another indication for Roux-en-Y-reconstruction without pouch is carcinoma of the cardia with intrathoracic anastomosis.³¹ But, in all other cases, reconstruction must be performed according to Roux-en-Y with Hunt-Lawrence pouch, as recently acquired knowledge suggests significant benefit of a pouch in the long run.^{40,49,50}

After total gastrectomy, curatively operated patients *might* benefit from a jejunal interposition (but there is no hard evidence for the advantage of a pouch) with maintenance of the duodenal passage, as the extra effort and risk of extra anastomoses/suture lines will be worthwhile only in a scenario of assured curative intention. It must be realized that aggressive surgery (extent of lymph node dissection and neighbouring organ resection) for advanced gastric cancer increases the risk of oesophagojejunal anastomotic leakage.⁸³ For this reason, most Japanese surgeons prefer to reserve jejunal interposition for younger better risk patients, benign disease, and in selected cases of curative resection of carcinoma stomach, especially if the tumour is within or shallower than muscularis propria.³⁰

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