

In Search of the Optimal Reconstruction Method after Total Gastrectomy. Is Roux-en-Y the Best? A Review of the Randomized Clinical Trials

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Rezumat

În căutarea metodei optime de reconstrucție după gastrectomie totală.

Este Roux-în-Y cea mai bună? Review al unor studii clinice randomizate

Au fost propuse numeroase proceduri, de reconstrucție, după gastrectomie cu scopul de a obține o morbiditate postoperatorie cât mai scăzută. Esojejunostomia Roux-in-Y este acceptată pe scară largă ca o metodă de reconstrucție standard datorită simplității sale și a rezultatelor nutriționale satisfăcătoare. Construcția unui rezervor gastric și menținerea duodenului în tranzit au fost propuse pentru a ameliora calitatea vieții pacienților cu cancer gastric. Scopul acestui studiu este de a evalua calitatea vieții pacienților cu diferite tipuri de reconstrucție după gastrectomie totală.

Metode: S-a efectuat o căutare sistematică în literatura de specialitate în PubMed, Science Direct, Wiley Online, Springer Link, până la 1 decembrie 2019. Au fost incluse doar articole originale publicate în limba engleză. Calitatea vieții a fost măsurată folosind diferite instrumente. S-au evaluat aspectele postoperatorii de esofagită de reflux, sindromul dumping, ingestia alimentară și statusul ponderal.

Rezultate: 15 studii au fost incluse în această cercetare. Au fost comparate trei tehnici de restabilire a continuității tractului digestiv: eso-jejunostomia Roux-în-Y, interpoziția jejunală și construcția unui rezervor gastric. S-au evaluat rezultatele statistice ale studiilor incluse, în ceea ce privește calitatea vieții și statusul ponderal.

Concluzii: Lungimea ansei alimentare pentru profilaxia refluxului esojejunal trebuie să fie de minim 50 cm, dar nu mai mare de 60 cm pentru prevenirea malabsorbției. Calitatea vieții a fost semnificativ

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îmbunătățită la pacienții la care s-a utilizat rezervorul gastric. Menținerea tranzitului duodenal nu pare să aducă niciun beneficiu în calitatea vieții, sau statusul ponderal, chiar dacă aceasta este o cale fiziologică.

Cuvinte cheie: reconstrucție după gastrectomie totală, pouch, interpoziție jejunală, calitatea vieții postgastrectomie totală

Abstract

Background: Numerous procedures for reconstruction after total gastrectomy have been proposed in order to achieve the lowest postoperative morbidity. Roux-en-Y esojejunostomy is widely accepted as a standard reconstruction technique due to its simplicity and its satisfactory nutritional outcomes. The construction of a gastric pouch and the maintenance of the duodenal transit have been proposed to ameliorate the quality of life of patients with gastric cancer. The aim of this study is to assess the quality of life of patients with different types of reconstruction after total gastrectomy.

Material and Method: A systematic literature search was performed in PubMed, Science Direct, Wiley Online, Springer Link, up to December 1, 2019. Only original articles published in English were included. Quality of life was measured using different instruments. Postoperative aspects of reflux oesophagitis, dumping syndrome, food intake and weight status were evaluated.

Results: 15 studies were included in this research. Three techniques for restoring the digestive tract continuity were compared: Roux-en-Y eso-jejunostomy, jejunal interposition and gastric pouch construction. The statistical results of the included studies were evaluated in terms of quality of life or weight status.

Conclusions: The length of the alimentary limb for prophylaxis of eso-jejunal reflux should be at least 50 cm, but not more than 60 cm for the prevention of malabsorption. The quality of life was significantly better in patients with gastric pouch. Maintaining the duodenal transit does not seem to bring any benefit in quality of life or weight status, even if this is a physiological way.

Key words: Roux-en-Y , pouch, jejunal interposition, gastrectomy quality of life

Introduction

Gastric cancer has been described since 3000 BC in hieroglyphic inscriptions and papyrus manuscripts from ancient Egypt. The first statistical analysis of cancer incidence and lethality showed that the frequency and mortality through gastric cancer were the highest. Subsequently, it remained one of the most important malignant diseases, with significant differences in geographical, ethnic and socioeconomic distribution (1).

Currently, gastric cancer is the 5th most common cancer and the third mortal cancer worldwide, with 783,000 deaths estimated in 2018 and is considered a disease with a

reserved prognosis especially in developing countries because of the diagnosis of the disease in advanced stages (2).

Although there has been an important progress in the treatment of stomach cancer in the recent years, surgical resection remains the treatment of choice for gastric cancer, which may require a total or subtotal gastrectomy depending on location and extent of the tumor (3).

The technique of reconstruction after gastrectomy for gastric cancer is still a debatable topic, the best method should keep postoperative morbidity as low as possible and to provide the best results at distance in terms of quality of life, too (3).

According to the Japanese guides, there are two types of reconstruction: those with preservation of the duodenal passage and those without maintaining the duodenal passage. The most known in the group of surgeries excluding the duodenal passage are: the simple Roux-en-Y procedure and the one with the construction of a reservoir. In the duodenal passage preservation group, jejunal interposition with and without the formation of a reservoir is the most common (4).

Worldwide, Roux-en-Y esojejunostomy is the most common reconstruction procedure after gastrectomy due to its simplicity and satisfactory nutritional outcomes (5).

The construction of a gastric reservoir has been proposed to get better the quality of life of patients with total gastrectomy, to prevent malabsorption and weight loss (6).

The purpose of this study is to evaluate the quality of life of patients with different types of reconstruction after total gastrectomy by conducting a systematic research in the specialized literature.

Material and Method

Strategy for Selecting Data from the Literature

A systematic literature search was performed in PubMed, Science Direct, Wiley Online, Springer Link. In each database, the following terms were considered as keywords: "gastrectomy reconstruction", "total gastrectomy", "pouch", "jejunal interposition", "gastrectomy quality of life".

All articles were carefully analyzed to find relevant literature data, including abstracts, studies, and references.

Selection of Articles

The eligibility criteria (*Table 1*) included original studies that aimed to assess the quality of life in patients with total gastrectomy for gastric cancer.

Studies were excluded if they met any of the following criteria: studies such as reviews, comments, letters, case series performed on less than ten patients, studies published in other language than English, studies that did not study the quality of life of patients with total gastrectomy.

There were identified 1584 potentially relevant studies. After reviewing 360 full-text articles, 345 were excluded for various reasons (*Fig. 1*). 15 studies were included.

Instruments for Assessing the Quality of Life

The quality of life was measured using different instruments. Currently, the tools most commonly used to measure quality of life are self-administered questionnaires, as patients themselves are the most appropriate source of information. These instruments must meet three methodological criteria: reliability, validity and responsibility (7) (*Table 2*).

Results

Articles that proposed to evaluate the quality of life of patients with different types of reconstruction after total gastrectomy between 1987-2019 were included in the study.

All patients included in the study were treated by total gastrectomy. From the histopathological point of view, most of the tumors were adenocarcinomas.

Table 1. Eligibility criteria

Criterion	Inclusion	Exclusion
Publication	1987-2019 English	Before 1987 and after 2019 Other language than English
Article design	Original articles	Clinical studies as reviews
Number of patients	Over 10	Less than 10
Treatment	Open or laparoscopic total gastrectomy, with curative intent	Other types of surgery

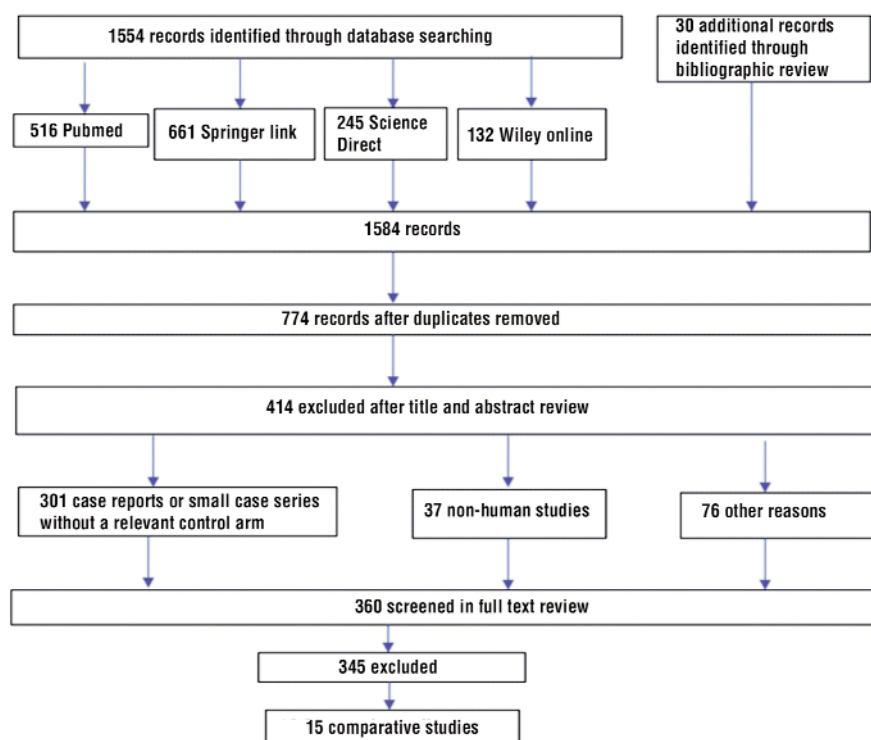


Figure 1. Criteria for the selection of articles

Table 2. Characteristics of the instruments used to measure the quality of life

Instrument	Format	Content	Addressability
EORTC QLQ-C30 and STO-22	Self-administered questionnaire with 22 questions. Used with the EORTC QLQ-C30 basic questionnaire (30 questions). It is divided into five scales and four unique questions [8].	<ul style="list-style-type: none"> - dysphagia - pain - reflux - digestion - anxiety - taste - hair loss - dry mouth 	specific for gastric cancer
GIQLI	Self-administered questionnaire with 36 specific and general questions. It is divided into five areas [9].	<ul style="list-style-type: none"> - psychological - social - disease-specific 	gastrointestinal diseases
GSRS	Self-administered questionnaire with 15 questions. It is divided into five groups of symptoms [9].	<ul style="list-style-type: none"> - reflux - abdominal pain - indigestion - diarrhea - constipation 	gastrointestinal diseases
Spitzer index	Self-administered questionnaire with 5 dimensions for quality of life assessment [9].	<ul style="list-style-type: none"> - activity level - daily living - health - family and friends support - perspectives 	cancer and other chronic diseases
Scorol Visick	Self-administered questionnaire to note the effect of surgery on symptomatology [10].	<ul style="list-style-type: none"> - complete resolution (grade I) - improvement (grade II) - no effect of surgery (grade III) - deterioration (grade IV) 	gastrointestinal diseases

The reconstructive procedures after total gastrectomy could be classed as: procedures with restoring intestinal continuity without preservation of the duodenal passage (Roux-in-Y eso-jejunosomy) and procedures with restoring intestinal continuity with preservation of the duodenal passage (jejunal interposition). These operations could be combined with the construction of a gastric "pouch" or "reservoir" (Roux-en-Y with pouch or jejunal interposition with pouch) (*Table 3*).

The size of groups was between 16 and 138 patients. 13 studies had less than 100 patients. Only randomized clinical trials were included. The total follow-up period varied considerably, ranging from 6 months to 5 years. There have been made comparisons between various procedures of reconstruction of the digestive tract.

Simple Roux-en-Y was compared with Roux-en-Y with reservoir in 7 studies and with jejunal interposition in two studies. The three reconstructive procedures were compared in 3 studies. Comparing the quality of life between studies was difficult, as six types of indicators were used (Visick, Spitzer, QLQ-C30, GSRS (Gastrointestinal Symptom

Rating Scale), Cushieri and institutional questionnaires). The QLQ-C30 questionnaire was used in 4 studies (18,22,23,25), GSRS questionnaire in two studies (17,19), Cushieri questionnaire (15) in one study, and non-standardized questionnaires in 6 studies (11,14,16,20, 21,24). The quality of life was assessed with the Visick scale in a single study (13).

Reflux Esophagitis

In our study only in 5 articles was analyzed, by endoscopy, the presence of reflux during the follow-up period (12,15,19,17,23). There were no signs of reflux oesophagitis at 3 years after surgery (15,19,23). In the rest of studies, no symptoms associated with reflux were mentioned. Other authors considered that the evaluation of esophago-jejunal reflux is not a criterion for assessing the quality of life.

Dumping Syndrome

The presence of dumping was analyzed in 4 studies (12,13,20,23). No patient reported

Table 3. Selected articles

Study	Year	Type of reconstruction	Quality of life	Instruments for measuring the quality of life	Weight status	Results
Troidl [11]	1987	Y+reservoir /eso-jejunosomy	S	Institutional questionnaire	S	Y+reservoir
Nakane [12]	1995	Y / Y+reservoir/ interpos + reservoir	NS	No questionnaire	S	Y+reservoir
Fuchs [13]	1995	Y+reservoir/ interpos+reservoir	NS	Visick scale and Spitzer index	NS	
Schwarz [14]	1996	Y / Y+Reservoir /interpos	NS	Institutional questionnaire	NS	
Iivonen [15]	2000	Y / Y + reservoir	S	Cushieri	NS	Y + reservoir
Nozoe [16]	2000	Y / Y + reservoir	S	Institutional questionnaire	S	Y + reservoir
Miyoshi [17]	2001	Y / Y + reservoir	S	GSRS	NS	Y + reservoir
Hoksch [18]	2002	Interpos+reservoir/interpos	S	QLQ-C30 questionnaire	NS	interpos+reservoir
Kono [19]	2003	Y / Y+reservoir	S	GSRS	S	Y+reservoir
Adachi [20]	2003	Y / Y + reservoir /interpos +reservoir	S	Institutional questionnaire	S	Y + reservoir
Ishigami [21]	2011	Y /interpos	NS	Institutional questionnaire	NS	
Ito [21]	2015	Y / Y+ reservoir	NS	QLQ-C30 questionnaire	NS	
Zonca [22]	2016	Y / Y + reservoir	S	QLQ-C30 questionnaire	-	Y + reservoir
Seung MooNoh [23]	2017	Y /interpos	NS	Institutional questionnaire	NS	
Tanaka [24]	2018	Y / Y+reservoir	NS	QLQ-C30 questionnaire	NS	

S - statistically significant, NS - not statistically significant

dumping 2 years after surgery in Nakane's study. Ivoen showed that dumping was more frequent in the Roux-in-Y group compared to the pouch group at 6 and 15 months after the operation. Analyzing results obtained by scintigraphy, Zonca found that dumping was more frequent in the Roux-en-Y group compared to the pouch group. In Fuchs study, 2 of 53 patients with Roux-en-Y reconstruction had symptoms associated with dumping compared to none of 53 patients with jejunal interposition. Patients undergoing Roux-en-Y reconstruction showed higher percentages of dumping compared to the pouch group (20)

Number of Meals and Volume of Ingested Food

Some authors noted that in the first six months postoperatively, at patients with total gastrectomy food intake was reduced to less than half the values before the operation. 79% of the patients in the pouch group were able to eat normal sized meals, compared with 14% of the patients in the Roux-en-Y group (15).

The quality of life was statistically significant in 8 studies (11,15,16,17,18,19,20,23) and statistically insignificant in 7 studies (12,13,14,21,22,24,25). Pouch Roux-en-Y was compared to simple esojejunostomy in 11 studies (11,12,14,15,16,17,19,20,22,23,25). In studies that analyzed the pouch Roux-en-Y compared to simple esojejunostomy there was a better quality of life in 7 studies (11,15,16,17,18,19,20,23), and in 4 studies (12,13,22,25) no significant differences were found. In the group that compared Roux-in-Y reconstruction with interposition, there were significant differences in one study (19) in favor of Roux-in-Y reconstruction, and in 4 studies (12,14,21,24) there were no differences.

Weight gain was statistically significant in 5 studies (11,12,16,19,20) and statistically insignificant in 9 studies (13,14,15,17,18,21,22,24,25).

5 studies (11,12,16,19,20) reported a significant weight gain in the pouch group compared to simple esojejunostomy, and no differences were found in 5 studies (14,15,17,

22,25). In the group that compared the Roux-en-Y with the jejunal interposition, only two study (12,20) reported a significant weight gain, while 5 studies (13,18,21,24) found no significant differences.

Discussions

Quality of life

The concept of quality of life has been widely discussed in the literature. The World Health Organization has defined the quality of life as "each person's understanding of their own position in life in the context of the education and value systems in which they live and in relation to their purposes, expectations, standards and concerns" (26).

Quality of life assessment actually is a major concern even for surgeons. The new trends are specifically aimed for oncological surgery, where particular attention must be paid to the outcome of the surgical treatment. Maintaining or improving the quality of life is not only a trend, but one of the main goals for those involved in the treatment of cancer patients. Cancer treatment affects the physical, emotional and social status of the patients. A "physiological surgery" as much as possible of the organs or functions, as possible, is one of the means of improving the quality of life of cancer patients. For each specific organ, the effect of surgical excision on quality of life is variable and needs to be approached specifically. Gastric cancer offers a wide range of quality of life issues. These are not only related to the loss of the stomach but also the loss of the related function (27).

Technological progress has improved the results of gastric surgery, assisting the surgeon to recreate the physiological state of the digestive process in those patients undergoing gastric resection. The surgeon is the one who has to deal with the functional results that are sometimes complex. These range from weight loss to anorexia, anemia, diarrhea and delayed reintegration into socio-professional life. An important issue is the nutritional aspect: intake, digestion and absorption are problems

caused by gastrectomy as well as the reconstruction procedure (27).

Food intake is limited due to loss of storage function, digestion and absorption are greatly reduced and only a small percentage of patients return to body weight during the period before surgery. (6)

After the total gastrectomy, the patients have an initial deterioration in most scales that measure the quality of life, but which gradually recover during 3-6 months after the operation (7).

It is very important to find an optimal type of reconstruction that can offer the highest quality of life with an optimum weight status and, at the same time, to minimize postoperative morbidities. Although over 70 different methods of gastrectomy reconstruction have been described, there is still no unitary opinion regarding the best technique after gastrectomy that would improve digestive function and quality of life. (27).

Quality of life was measured using different tools and reported in various ways. Currently, the instruments most commonly used to measure quality of life are self-administered questionnaires, because the patient himself is the most appropriate source of information about his own quality of life. These instruments must meet 3 methodological conditions: reliability, validity and responsiveness and are divided into generic, symptom-related and cancer-specific (7).

According to studies in the literature, the most appropriate instrument for evaluating the quality of life of gastrectomised patients for gastric malignancies is the "Quality of Life Index" described by Eypasch. Unlike instruments that refer to a single dimension as the Cuschieri score for gastrointestinal symptoms and the non-specific instruments for the overall health assessment of cancer patients, such as the this validated questionnaire properly presents the multidimensional concept of quality of life by assessing symptoms and physical, emotional and social function (28).

The GIQLI index proved to be superior to the European Organization for Cancer

Research and Treatment EORTC QLQ-C30 index, which was developed specifically to estimate the quality of life in patients with gastrointestinal diseases and especially those undergoing surgical treatment (28).

EORTC QLQ-C30, is specific for cancer patients, includes 5 functional scales (physical, occupational role, emotional, cognitive and social), 3 symptom scales (fatigue, pain, nausea/vomiting) and a scale for considering the general condition of quality of life, plus 5 unique questions related to specific symptoms (dyspnoea, loss of appetite, sleep disorders, constipation and diarrhea). The response categories comprise four categories: "not at all", "little", "quite" or "very much" or as a modified visual analogue scale, from 1 to 7 (30).

STO22, is a module for QOL assessment for gastric cancer and focuses in particular on gastric cancer symptoms and side effects. It includes 22 elements that form five scales (dysphagia, pain and discomfort in the abdominal area, dietary restrictions, upper gastrointestinal symptoms and specific emotional problems) and four unique items (dry mouth, two questions about hair loss and body image) (7). Supporters of this measure instrument consider that quality of life is one of the main parameters to be evaluated in studies of gastric cancer surgery outcomes and this is achieved with specific measuring instruments (7).

The Importance of Choosing the Reconstruction Procedure for the Quality of Life

Advantages of the jejunal pouch

The construction of the pouch was designed to provide a gastric replacement. The pouch should lead to improved quality of life, allow higher food intake at a meal and help to prevent malabsorption and weight loss (7).

The importance of the gastric pouch is difficult to assess. Many studies have reported the benefits of using the jejunal pouch. Troidl and colleagues were the first to evaluate the benefit of using the pouch after total gastrectomy. They compared two

procedures for restoring digestive tract continuity without preserving the duodenal passage: Roux-in-Y with reservoir and simple eso-jejunosomy. For patients with a survival for more than 1 year, they reported a better quality of life in the case of the reservoir (11). Nakane also confirmed the benefits of using the jejunal reservoir (12). Schwarz's study, although using an individual quality of life assessment system, which was not described in detail, showed an improvement in quality of life after pouch construction compared to simple Roux-in-Y reconstruction (14). Iivonen and colleagues compared two reconstructive procedures: simple Roux-in-Y and the construction of a jejunal reservoir and recommended that reconstruction after total gastrectomy must be in form of a jejunal pouch (15). They reported a better quality of life in the case of use the pouch at 5 years after the operation compared to the reconstruction without a pouch (16). Kono found a better quality of life and a lower incidence of biliary reflux in the jejunal reservoir compared to simple Roux-in-Y reconstruction (19). Adachi's study compared long-term results after three reconstruction methods: Roux-en-Y, Roux-en-Y with reservoir, and jejunal interposition. The pouch was superior to Roux-en-Y reconstruction in terms of postoperative quality of life (20). Zonca was of the same opinion in his study (23).

On the other hand, in some studies it was not possible to identify any benefit in using the pouch. Also, Ito and co-workers failed to demonstrate the benefits of using the gastric pouch in terms of quality of life at 12 months after surgery (22).

The short-term effect of pouch reconstruction has been favorable in some randomized studies (16,19). These studies indicate that the jejunal pouch functions as a gastric reservoir and contributes to improved postoperative nutritional status compared to simple Roux-in-Y reconstruction (29).

Other studies demonstrated that digestive capacity increases over time in all types of reconstructions and any difference between procedures tends to disappear in the long term (19,31).

Maintaining the duodenum in transit

Maintaining the duodenum in transit presents more theoretical nutritional advantages. Any process that by-pass the duodenum results in a massive release of postprandial entero-glucagon that causes delayed carbohydrate absorption, but does not stop it.

The preservation of the duodenum allows the alimentary bolus to mix with the biliary-pancreatic secretions and guarantees a fibroscopic access to the duodenum. Restoration of digestive continuity by jejunal interposition between the esophagus and duodenum appears to be more physiological than the Roux-en-Y, but involves an additional anastomosis (33) and presents a higher risk of biliary reflux (34). The Roux reconstruction has better results than the jejunal interposition in replacing the reservoir function, without producing early satiety (34).

In other study, Fuchs used the Visick score and the Spitzer index and found no significant difference in terms of quality of life between jejunal interposition with pouch and Roux-in-Y reconstruction (13). The same conclusion was reached by Ishigami, who compared jejunal interposition with Roux-in-Y reconstruction. He pointed out that in the long term, nutrition status and quality of life were equalized between the two groups (21).

Nakane compared the Roux-in-Y reconstruction with or without a reservoir to jejunal interposition with pouch. After two years of follow-up, no significant advantage was reported for keeping the duodenum in transit (28).

The importance of length of the alimentary limb of Roux-en-Y

Alkaline reflux esophagitis is a post-operative complication that may occur after total gastrectomy, and its incidence depends on the type of reconstructive surgery. From this point of view, Roux-en-Y esophago-jejunosomy is the preferred method of reconstruction, because it is followed by a lower rate of alkaline esophagitis compared to other procedures

(simple esophagojejunostomy, esophago-duodenostomy) (35-38), considered by some authors a method of preventing alkaline reflux in the esophagus (39).

Jejunal reflux into the esophagus may be accompanied by reflux symptoms: retrosternal pain, regurgitation and/or bitter taste. Reflux can be evaluated by scintigraphic methods, bilimetry (measurement of bilirubin concentration in the esophagus) and monitoring of 24-hour intraesophageal pH (Holter) to confirm the presence of alkaline pH in the esophagus (40). Alkaline reflux esophagitis, a complication of jejunoesophageal reflux, consists of inflammatory mucosal lesions. There are few studies that analyze endoscopic aspects of alkaline reflux esophagitis, these include a relatively small number of patients, and the reported results are variable (41,42).

The variability of the incidence of alkaline reflux oesophagitis after Roux-en-Y may depend on the surgical technique and especially on the length of the jejunal limb, which should be after some authors at least 35 cm (preferably over 50 cm) (40,41).

The most appropriate dimensions of alimentary and biliopancreatic limbs in the Roux-in-Y reconstructions remain unclear. The dimensions of the alimentary loop vary from 50 to 150 cm and for the biliopancreatic limb from 20 to 120 cm. (43,44)

Many studies have shown that the problem of reflux is strongly associated with a short food intake - below 20 cm, and when it is too long - over 60 cm, problems of absorption and metabolism appear. (45)

Body Weight

Weight loss and malnutrition are also common problems after total gastrectomy leading to diminished postoperative quality of life. These can be explained by the reduced food intake as a result of the loss of stomach function (46)

Weight loss after total gastrectomy usually extended during the first year after surgery and most patients do not regain weight before surgery. Recent studies have shown that the quality of postoperative life is closely related

to weight loss and the presence of a reservoir after total gastrectomy results in increased postoperative body weight. (32)

In other studies, no significant differences in weight were observed in the pouch group compared to another type of reconstruction. Schwarz and colleagues did not find differences in body weight in patients who underwent pouch Roux-en-Y reconstruction versus those without a pouch (14). Ivoen and colleagues compared the pouch with the simple Roux-in-Y reconstruction over a 4-year period and found an equal weight increase between the two groups (15). Another study showed that pouch construction did not significantly improve body weight (19).

Regarding jejunal interposition, an increase in body weight was observed in the studies of Nakane and Adachi. Significant results were reported 12 months after the operation in Nakane's study and throughout the follow-up period in Adachi's study (47).

There was no association between preservation of the duodenal transit and post-operative weight in Fuchs' study (13). Even Ishigami failed to show the superiority of the jejunal interposition over Roux-in-Y in terms of long-term weight gain (21).

Conclusions

For the prophylaxis of esophago-jejunal reflux the length of the alimentary limb should be at least 50 cm, but not greater than 60 cm to prevent malabsorption. Quality of life was significantly improved in patients with gastric pouch. Maintaining duodenal transit does not seem to bring any benefit in quality of life, or weight status, even if this is a physiological path. In order to demonstrate the superiority of any reconstruction technique, several studies should be performed on a larger number of patients and with valid instruments for estimating the quality of life.

Conflict of Interest

The authors declare no conflicts of interests.

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