

PROSPECTIVE SEQUENTIAL ENDOSCOPIC AND HISTOLOGIC STUDIES OF THE GASTRIC POUCH IN 130 MORBIDLY OBESE PATIENTS SUBMITTED TO ROUX-EN-Y GASTRIC BYPASS

Estudos endoscópico e histológico prospectivos e sequenciais da bolsa gástrica em 130 pacientes obesos mórbidos submetidos à bypass gástrico em Y-de-Roux

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ABSTRACT – Background - Roux-en-Y gastric bypass is the most common performed bariatric surgery. A small gastric pouch is created, leaving a narrow gastrojejunal anastomosis, with a long jejunal limb. Very little is known regarding the behavior of this pouch years after surgery. **Aim** - To determine through prospective sequential endoscopic studies the size of the gastric pouch, the diameter of the anastomosis, and the behavior of H. pylori infection after surgery. **Methods** - In 130 patients subjected to resectional gastric bypass, several routine sequential endoscopic (until 120 months) and histological evaluations of the gastric pouch were performed. **Results** - After surgery, a mean of 3.6 endoscopies/patient were performed. Macroscopically nearly 95% of the small gastric pouches were normal, and the main pathological finding was a marginal ulcer. Erosive esophagitis disappeared in 93% of the patients. There was no increase in the orocaudal size of the pouch during this period of observation. There was no dilatation of the diameter of gastrojejunal anastomosis. Near 54% of all patients had normal fundic mucosa, while 18% had chronic active gastritis, coincident with H. pylori infection. Five patients had intestinal metaplasia. **Conclusion** - Based on this sequential endoscopic evaluation, there was no increase in the orocaudal size of the gastric pouch nor increase in the diameter of the gastrojejunal anastomosis. H. pylori behavior was inconsistent and difficult to interpret.

HEADINGS – Gastric bypass. Gastrojejunal anastomosis. Jejunal limb

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RESUMO – Racional - Bypass gástrico em Y-de-Roux é a operação bariátrica mais comumente realizada. Pequena bolsa gástrica é criada, deixando uma anastomose gastrojejunal estreita, com uma alça jejunal mais comprida. Muito pouco é conhecido sobre o comportamento desta bolsa em anos após o procedimento. **Objetivo** - Determinar através de estudos prospectivos endoscópico e histológico sequenciais o tamanho da bolsa gástrica, o diâmetro da anastomose e o comportamento da infecção por H. pylori após a operação. **Métodos** - Em 130 pacientes submetidos ao bypass gástrico foram realizadas várias avaliações sequenciais endoscópica (até 120 meses) e histológica de rotina da bolsa gástrica. **Resultados** - Após a operação, foram realizadas em média 3,6 endoscopias por paciente. Macroscopicamente quase 95% das pequenas bolsas gástricas eram normais, e o principal achado patológico foi uma úlcera marginal. Esofagite erosiva desapareceu em 93% dos pacientes. Não houve aumento no tamanho orocaudal da bolsa durante o período de observação. Não houve dilatação do diâmetro da anastomose gastrojejunal. Perto de 54% de todos os pacientes tinham mucosa fúndica normal, enquanto 18% tinham gastrite crônica ativa, coincidente com a infecção por H. pylori. Cinco pacientes tinham metaplasia intestinal. **Conclusão** - Com base nesta avaliação endoscópica sequencial, não houve aumento no tamanho orocaudal da bolsa gástrica, nem do diâmetro da anastomose gastrojejunal. O comportamento do H. pylori foi inconsistente e difícil de interpretar.

DESCRITORES - Derivação gástrica. Anastomose gastrojejunal. Alça jejunal

INTRODUCTION

Roux-en-Y gastric bypass, performed either by laparotomy or laparoscopic approach, is the most frequently performed operation, and it is regarded as the gold standard of bariatric surgery^{1,3,13,20}. In this mixed restrictive and malabsorptive operation, a small gastric pouch (approx. 20 ml) is created, anastomosed to a Roux-en-Y jejunal limb between 100 and 150 cm long. Currently, the early endoscopic evaluation (2-6 months after surgery) has been the main indicator for this approach, mainly in symptomatic patients^{2,10,12,14,16,17,18,19,21,22,23,24,26,27}. However, there are many new endoscopic procedures and techniques used for these obese patients which have been designed as alternative management and therefore, we believe that the knowledge of the long-term macroscopic and histological aspects of all bariatric procedures will be increasingly necessary.

We have performed two prospective endoscopic evaluations one to two months after surgery in a great number of patients subjected to gastric bypass, seeking the real incidence of marginal ulcers and anastomotic strictures^{5,6}. We also have performed a prospective endoscopic and histological evaluation of both the gastric pouch and jejunal limb at a mean of 27 months after surgery¹⁰. This is the only prospective study, compared to ten previous endoscopic studies, which were all retrospective and performed in symptomatic patients^{2,12,14,16,17,18,19,21,22,23,24,26,27}.

Therefore, the purpose of the present prospective investigation was to perform routine sequential endoscopic studies (at least three in different periods) after surgery, in order to determine two aspects: a) behavior of gastric pouch in terms of pathological findings and eventual increase in size or diameter of anastomosis; b) variations in the gastric pouch when infected with *H. pylori*.

METHODS

This prospective evaluation is based on the original study published in 2006¹⁰ in which 227 patients were subjected to one postoperative endoscopic evaluation. Out of all of these patients, 130 (57.3%) agreed to perform several routine sequential endoscopic evaluations (at least three) and participate in the present study.

They were 101 women (78%) and 29 (22%) men, with a mean age of 47.1 years (range 18 to 64). The mean body mass index before surgery was 44.9 kg/m² (range from 35.4 to 53.8). All gave their informed consent to be included in this study. Only 12 patients (9.2%) had upper abdominal pain, while 118 were asymptomatic, that is, with absence of pain, nausea, vomiting or dysphagia. One patient had upper digestive bleeding.

All endoscopic evaluations were performed by one of the authors (AC) employing an Olympus

Videoendoscope (Tokyo, Japan). After a 12h fast, pharyngeal anesthesia with lidocaine 4% was administered and buscapine and midazolam were employed as pre-medication. The endoscope was gently introduced, avoiding the "pull and push" effect and three segments were carefully evaluated: a) the distal segment of the esophagus and esophagogastric junction; b) the macroscopic aspect of the gastric pouch, also measuring the orocaudal length of the pouch, from the distal end of the esophagogastric junction (place when the gastric folds end), up to the gastrojejunal anastomosis, as shown in Figure 1; measurement were performed twice, through antegrade and retrograde endoscopic steps and two biopsy samples were taken in each examination in 105 patients (77%); 3) the diameter of the gastrojejunal anastomosis as shown in Figure 1, knowing that the real diameter of the scope was 11 mm.

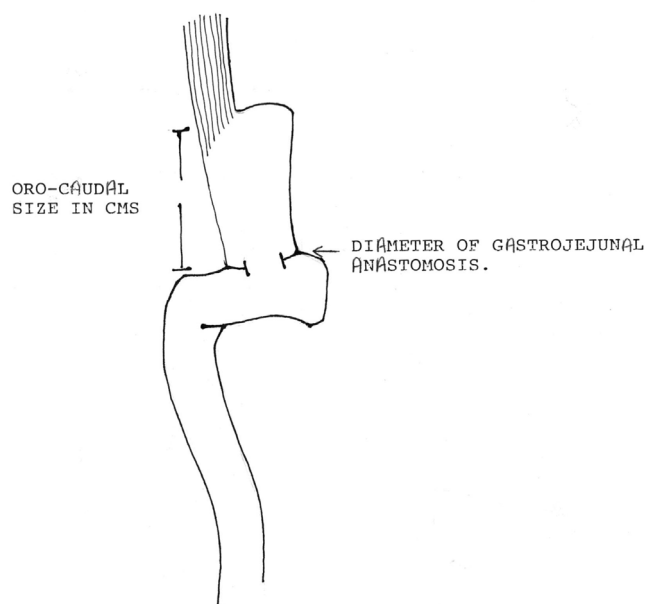


FIGURE 1 - Endoscopic method to measure the orocaudal size of the gastric pouch and the diameter of gastrojejunal anastomosis

All samples were immediately submerged in 10% formaline and sent for histological evaluation. They were stained with Hematoxylin eosine and Alcien blue, in order to determine the presence of goblet cells. The type of gastritis was defined according to the Sydney classification 22. The presence of *H. pylori* infection at the gastric pouch was evaluated in 105 patients (77%) and compared with preoperative findings at the gastric antrum.

All patients were submitted to an open Roux-en-Y gastric bypass, as described before 23. The volume of the gastric pouch was less than 30 ml. The gastrojejunal anastomosis was performed with a circular stapler 25 (Covidien, USA), leaving an internal diameter of 15 mm. The length of the jejunal limb was 125 to 150 cm.

RESULTS

Before surgery, endoscopic evaluation was completely normal in 66 patients (50.8%), while 64 had one or more pathological findings: distal erosive esophagitis was present in 31 patients (23.8%), presence of a small hiatal hernia between 2 to 4 cm was seen in 25 (19.2%), dilated cardia type III/IV of Hill's classification was seen in 31 patients (23.8%) and peptic ulcers were found in four (3.0%): two gastric and two duodenal ulcers.

The endoscopic performance of the 130 patients is shown in Table 1. It can be seen that all patients had at least three endoscopic evaluations in different periods of time. This examination was scheduled at specific times in years after surgery: 1, 4, 5, 7, 9 and 10 years. Therefore, the follow-up period lasted up to 120 months after surgery. The mean number of postoperative endoscopies was 3.6/patient.

TABLE 1 - Endoscopic performance before and after Roux-en-Y gastric bypass (N= 130)

Moment of endoscopy	n	%	Mean time (months postop)
Preoperative	130	100	
Postoperative I	130	100	14.1
Postoperative II	130	100	44.8
Postoperative III	130	100	66.4
Postoperative IV	45	34.6	85.0
Postoperative V	30	23.0	99.3
Postoperative VI	5	3.8	120
Total postoperative endoscopies			
470 = 3.6/patient.			
Mean follow-up 92 months (60-120)			

Table 2 demonstrates the pathologic findings in the sequential endoscopic evaluations of the gastric pouch. Twelve patients (9.2%) presented upper abdominal pain. Out of them, five (42%) presented a marginal ulcer, while seven had normal findings. The single patient with gastrointestinal hemorrhage showed a marginal ulcer, but did not need endoscopic therapy. Marginal ulcers were seen in each endoscopic evaluation in a small proportion. Five of these seven patients were heavy smokers. As aforementioned, only five out of seven patients with marginal ulcers were symptomatic and one presented a sudden upper GI hemorrhage seven years after surgery. The patient was treated with proton pump inhibitors for six months and all of the following endoscopies revealed complete healing of the ulcer and there was no recurrence. All 31 patients with erosive esophagitis before surgery (93.5%) were treated with PPI's for three months after surgery. The consecutive endoscopic evaluations showed normal esophageal mucosa

TABLE 2 - Pathological findings in sequential endoscopic evaluation of the gastric pouch

	Endoscopic Evaluation					
	I n = 130	II n = 130	III n = 130	IV 45	V n = 30	VI n = 5
Months after operation	14	41	66	85	99	120
Normal	128 (98%)	125 (99%)	125 (96,1%)	40 (88,9%)	30 (100%)	5 (100%)
Marginal ulcer	2 (1,5%)	2 (1,5%)	2 (1,5%)	1 (2,2%)	-	-
Esophagitis	-	-	3 (2,3%)	2 (4,4%)	-	-
Other	-	-	-	2 (7,1%)	-	-
Mean lenght gastric pouch (mm)	27,6	29,7	31,1	29,5	28,0	30,0
Mean diameter gastrojejunal anastomosis (mm)	15	15	15	15	15	15

in all, with the exception of two patients (6.4%) who presented recurrence of erosive esophagitis 85 months after surgery. Furthermore, three patients with normal preoperative endoscopies presented erosive esophagitis 66 months after surgery. All were treated with proton pump inhibitors. Two patients presented miscellaneous findings such as a fundic glandular small polyp and a granuloma due to a foreign body (silk). The mean length of the gastric pouch during the sequential evaluation remained at 3 cm (2 to 5), with no significant increase in the orocaudal length: 98 patients (75.4%) with a diameter between 2 to 3 cm and 32 patients (24.6%) a diameter between 4 to 5 cm. The diameter of the gastrojejunal anastomosis remained at 15 mm in all patients during the study. Therefore, in the great majority of patients (96% to 98%) the gastric pouch was normal.

Table 3 shows the histological findings and the presence of H. pylori infection at the gastric pouch. A total of 294 histological evaluations were performed after surgery. It can be seen that 54% of the patients have normal fundic mucosa. Presence of intestinal metaplasia was seen in five patients, while chronic active gastritis was seen in 19 patients, coinciding with the infection of H. pylori (18.1%). Chronic inactive gastritis was seen in 33% of the cases. The behavior of H. pylori infection was irregular and unpredictable. Nearly 54% remained free of infection, while 8.6% had H. pylori infection before and after surgery. However, some patients had a negative study before surgery, but after surgery, tested positive for H. pylori infection, while some others with positive findings before surgery, showed no infection late after operation. None of the positive patients were treated using antibiotic eradication.

TABLE 3 - Histological findings and behavior of H. pylori infection of the gastric pouch and jejunal limb in postoperative endoscopic studies (N = 105)

Histological evaluation gastric pouch	n	%	
Normal pre and post operative fundic mucosa	32	30.4	54.2
Normal postoperative fundic mucosa	25	23.8	
Chronic active gastritis	19	18.1	
Chronic inactive gastritis	24	22.8	
Intestinal metaplasia	5	4.8	
Helicobacter pylori infection			
Negative before and after surgery	32	30.4	
Negative in postoperative studies	25	23.8	
Positive before and after surgery	9	8.6	
Negative before and positive after surgery	10	9.5	
Positive before and negative after surgery	29	27.6	
Total (+) postoperative H. pylori	19	18.1	

DISCUSSION

The results of the present prospective and routine sequential endoscopic evaluation after Roux-en-Y

gastric bypass in morbidly obese patients suggest that: a) the small gastric pouch has a normal macroscopic appearance in the great majority of patients subjected to sequential endoscopic evaluations up to 120 months after surgery; b) there is no significant increase in the orocaudal length of the gastric pouch; c) there is no dilatation of the gastrojejunal anastomosis; d) *H. pylori* infection shows an inconsistent behavior.

The extensive review of the literature concerning endoscopic studies after gastric bypass^{2,12,14,15,16,17,18,19,21,22,23,24,26,27,28} has demonstrated that all are retrospective, performed in a small number of selected patients, usually with symptoms and only once after surgery. There is no prospective and sequential endoscopic evaluation and therefore our study is the first one, making it difficult to compare with other publications. Even though some authors suggest that endoscopy is an important tool not only for diagnosis, but also in the management of patients with complex complications, it is rarely needed at the late control (two months after surgery and beyond)^{16,18,27}. Nevertheless, we were interested to know what would happen with the small gastric pouch after surgery, determined by objective measurements and not only by eventual symptoms.

It can be seen that the development of late marginal ulcers, as we have described before^{5,10} is probably the most important adverse effect in the follow-up after surgery. Its importance, diagnosis and management have been extensively evaluated in these two publications and it is not the purpose of this study to repeat it. It is important to notice that endoscopic manifestations of reflux esophagitis heal in near 93% of the patients after Roux-en-Y gastric bypass, being this procedure an excellent antireflux operation, as we have suggested before⁷. However, three patients developed erosive esophagitis late after surgery, probably associated with smoking. None of them showed an increase in pouch size.

The present study demonstrates that repeated endoscopic evaluation of the size of gastric pouch do not indicate a significant increase in it. Very few studies have evaluated this particular aspect retrospectively, either by radiological method⁶ or by endoscopic evaluation^{12,25} suggesting that there is no increase in size. Wetter²⁷ described a residual pouch size of 5 to 7 cm, which is much larger, compared to our results. Therefore, the increase in weight seen two or more years after surgery is not due to "pouch dilatation", but rather to an increase in the amount of food ingested. We have recently published the results in our patients eight to ten years after surgery concerning the effect of gastric bypass on the percentage of excess weight loss, and the changes in comorbidities⁸. An increase in weight is observed after surgery, which is parallel to preoperative weight. However, the gastric pouch maintains a similar size during the entire follow-up period. In the same way, there is also no dilatation of the gastrojejunal anastomosis, due to the fact that it

was constructed with a circular stapler²⁵, which leaves an internal diameter of 15 mm. We do not know whether manual sutures would eventually produce an anastomotic dilatation. However, we can predict that the linear stapler performance of the anastomosis will have a similar behavior as the circular stapler, with no increase in size.

The behavior of *H. pylori* infection was inconsistent and difficult to evaluate and understand clearly. This behavior has shown a wide spectrum of possibilities. In the present study we found 18% of patients with *H. pylori* infection of the small gastric pouch late after surgery, which is less than the 31% we published before, evaluated two years after surgery¹⁰. One reason could be the fact that in the present investigation five patients had positive finding of *H. pylori* infection 12 months (four patients) or 24 months (one patient) after surgery, while in the subsequent examinations this infection disappeared. For a practical purpose of our study, these patients were considered as negative for *H. pylori*. However, early after surgery they would be considered positive, according to our previous initial study. We have not performed any eradication, because we believe that it is highly improbable that adenocarcinoma will develop in the gastric pouch, providing that no intestinal metaplasia is present and sequential endoscopic studies are performed. We have recently published a prospective endoscopic and histological study in 79 patients subjected to subtotal gastrectomy and Roux-en-Y anastomosis for benign diseases⁹. They were submitted to four endoscopic studies after surgery. Among them, three groups of patients were identified: a) 43 patients who had no infection of *H. pylori* before surgery and who remained so after surgery (54%), which is almost exactly the 54% of patients in the present study; b) 21 patients (27%) with no preoperative infection, but presented infection of the gastric remnant after surgery; and c) 15 patients (19%) who presented *H. pylori* infection before and after surgery, which means a total of 46% with *H. pylori* infection.

In the present study, only 18% of patients had positive findings, in contrast to this publication. One possible reason for this difference could be based on leaving a very small gastric pouch after gastric bypass, compared to the 50 to 60% gastrectomy performed for benign diseases which leaves the remnant gastric pouch eight to ten times larger.

One major criticism to this manuscript would be: "Why did we feel the need to do this study?". As previously pointed out, all endoscopic evaluations have been performed on symptomatic patients, representing only 7-12% of the total bariatric patients^{16,18,22,28}. However, we believe that it is imperative to demonstrate objectively the subjective feeling of what happens with the esophagogastric area in morbidly obese patient's years after surgery. Is there any change in the size of a normal pouch, without an ulcer or stricture? Is there an increase (as believed by many authors) in the diameter

of the gastrojejunal anastomosis? Is there complete healing of reflux esophagitis and with no recurrence? These are some of the questions that we tried to answer in an objective way in the present study.

The limitations of our study could be the precise measurement of the size of gastric pouch and the diameter of the gastrojejunal anastomosis. We could only measure precisely the orocaudal length of the gastric pouch, but we have not performed radiological studies in order to determine an increase in the total volume of the gastric pouch. However, as pointed out beforehand^{7,12}, previous radiological studies did not demonstrate an increase in the size of the pouch. On the other hand, the gastrojejunal anastomosis was measured comparing it with the diameter of the scope and no increase in its diameter was observed. This is probably due to the fact that all anastomosis were made with a circular stapler, which does not allow an increase in its diameter.

Finally, we believe that understanding and becoming familiar with the structural and functional details of the distal esophagus, the small gastric pouch and the behavior of the gastrojejunostomy is fundamental for the surgeon and for the endoscopist in order to diagnose complications, and therefore, to perform various endoscopic treatments, and in this way avoid inadequate interventions. According to our results, no routine endoscopic follow-up is needed in patients with gastric bypass

CONCLUSION

In relationship to the behavior of gastric pouch in terms of pathological findings and eventual increase in size or diameter of anastomosis, we conclude: a) erosive esophagitis disappears in nearly 93% of the patients; b) the gastric pouch is normal during several endoscopic studies in 96-98% of the cases; c) late marginal ulcer can occur, which is treated medically and no recurrence has been observed; d) there is no orocaudal dilatation of the pouch; e) gastrojejunal anastomosis remains with the same diameter.

In relationship to variations in the gastric pouch when infected with *H. pylori* we conclude that half of the patients had normal fundic mucosa in the gastric pouch, and the rest may present chronic active gastritis (in accordance to *H. pylori* infection) or chronic inactive gastritis or even intestinal metaplasia. *H. pylori* infection was present in 18% of the patients, showing a wide spectrum of behavior, difficult to understand.

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