ORIGINAL ARTICLE

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Do *Helicobacter pylori* infection and eradication therapy status influence weight loss outcomes and endoscopic findings after Roux-en-Y gastric bypass? A historical cohort study

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HIGLIGHTS

- *H. pylori* infection status did not influence post-RYGB weight loss.
- Pre-operative *H. pylori* infection associated with gastritis.
- New-onset *H. pylori* infection was a protective factor against post-RYGB jejunal erosions.

ABSTRACT – Background – Currently, there is conflicting evidence linking *Helicobacter pylori* (HP) infection with weight loss and endoscopic findings after Roux-en-Y gastric bypass (RYGB). **Objective –** To identify correlations between HP infection and its eradication with weight loss and endoscopic findings after RYGB. **Methods –** This is an observational retrospective cohort study based on a prospectively collected database of individuals who underwent RYGB from 2018–2019 at a tertiary university hospital. HP infection and the HP eradication therapy outcomes were correlated with post-operative weight loss and endoscopic findings. Individuals were classified according to the status of HP infection into four groups: no infection; successful eradication; refractory infection; and new-onset infection. **Results –** Of 65 individuals, 87% were female and the mean age was 39±11.2 years. Body mass index significantly decreased from 36.2±3.6 to 26.7±3.3 kg/m^2 one year after RYGB (P<0.0001). The percentage of total weight loss (%TWL) was 25.9±7.2% and the percentage of excess weight loss was 89.4±31.7%. HP infection prevalence decreased from 55.4% to 27.7% (P=0.001); 33.8% never had HP infection, 38.5% were successfully treated, 16.9% had refractory infection and 10.8 % had new-onset HP infection. %TWL was 27.3±7.5% in individuals who never had HP, 25.4±8.1% in the successfully treated, 25.7±5.2% in those with refractory infection, and 23.4±6.4% in the new-onset HP infection group; there were no significant differences among the four groups (P=0.6). Pre-operative HP infection significantly associated with gastritis (P=0.048). New-onset HP infections significantly associated with a lower frequency of jejunal erosions after surgery (P=0.048). **Conclusion –** No effects of the HP infection on weight loss were identified in individuals undergoing RYGB. A higher prevalence of gastritis was observed in individuals with HP infection before RYGB. New-onset HP infection after RYGB was a protective factor for jejunal erosions.

Keywords – *Helicobacter pylori*; gastric bypass; obesity; bariatric surgery; weight loss.

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INTRODUCTION

Helicobacter pylori (HP) infection is one of the most common infections in humans and affects about half of the world's population, especially in developing countries and in socioeconomically disadvantaged populations. This infection is associated with peptic disease and gastric cancer. Some authors have also described the existence of a correlation between post-operative complications of gastric surgery and the presence of HP infection[1-3].

The occurrence of a higher prevalence of HP infection in individuals with obesity is still a topic of debate, with studies that reported a higher prevalence within this group than in the population without obesity[4-6]. Studies on the rates of HP infection in individuals with severe obesity awaiting bariatric surgery (BS) are conflicting[7,8]. Furthermore, the success rate of the HP eradication therapy in individuals with obesity is reportedly lower when compared to the population without obesity, possibly because of underdosing[9].

In the current scenario, there are recommendations to carry out the HP screening and eradication before BS[10]. However, there is still a lack of consolidated data on the post-operative outcomes of BS in individuals with HP and the real impact of this infection on these patients. HP infection is associated with higher rates of marginal ulcer[11,12]; however, it has little to no reported impact on other post-operative BS outcomes[13]. Considering that there is also conflicting evidence in the current literature linking HP infection with obesity, and chronic inflammation, it is debatable whether it could also impact weight loss outcomes after BS[14].

This study aims at analyzing the prevalence of HP infection in individuals undergoing BS at a tertiary university hospital and identifying possible correlations between this infection and its treatment with weight loss and endoscopic findings after surgery.

METHODS

Study design

This is a retrospective observational cohort study that was carried out at a tertiary university hospital. It was based on a prospectively collected database from medical records of individuals undergoing BS (Roux-en-Y gastric bypass – RYGB) from 2018 to 2019. HP infection and the success or not of HP eradication therapy were correlated with post-operative weight loss and endoscopic findings. The research protocol was analyzed and approved by the local institutional review board under the opinion. Informed consent was obtained from all participants.

Study population

The present protocol included individuals with obesity who consecutively underwent primary RYGB indicated according to the National Institutes of Health criteria, of both sexes, and aged 18 through 70 years old, who underwent a pre-operative esophagogastroscopy and then another endoscopic examination at least 6 months after BS. Pre-operative esophagogastrocopies are systematically performed, while post-operative examinations are not routinely done; after surgery, esophagogastroscopies are only performed when there are related complaints or clinical abnormalities. The exclusion criteria were no post-operative endoscopic examination; individuals belonging to vulnerable groups (underaged or mentally/intellectually disabled); compliance to post-operative follow-up for less than 12 months; non-adherence to treatment for HP eradication; use of non-steroidal anti-inflammatory drugs; other gastric operation in addition to BS.

From 230 medical records of individuals undergoing primary RYGB within this time-period, 65 who met the proposed criteria were included. The main reasons for exclusion were no post-operative endoscopic evaluation (N=125), compliance to post-operative consultations under 12 months (N=39), and non-adherence to pre-operative HP eradication therapy (N=1).

Demographic and anthropometric variables

The following variables were studied: age, gender, and body mass index (BMI). Weight loss was analyzed through the percentage of total weight loss (%TWL) and the percentage of excess weight loss (%EWL), considering the final BMI as that observed after one year of post-operative follow-up and the baseline BMI baseline that observed at the time of surgery.

Endoscopic variables

All individuals undergo a pre-operative esophagogastroduodenoscopy. After surgery, exams are selectively performed and indicated according to symptoms or specific complaints. All examinations were carried out by the same Digestive Endoscopy team. The main findings that were analyzed are the presence of: esophagitis; gastritis; duodenitis; gastric ulcer; and duodenal ulcer. Post-operatively, the duodenum is not evaluated and the presence of ulcers in the gastroenterostomy are considered marginal ulcers. Small linear or round lesions with diameters that did not exceed a few millimeters in the mucosa of the efferent limb were considered jejunal erosions.

HP screening is carried out through the urease test and histopathological examination with Giemsa stain of biopsies collected during esophagogastroduodenoscopies.

Helicobacter pylori eradication therapy

All individuals in whom HP infection was detected before BS underwent eradication treatment, which consisted of the association of Amoxicillin 1.0 gram and Clarithromycin 500 mg with a proton-pump inhibitor (Omeprazole, Pantoprazole or Esomeprazole 20 or 40 mg or Lansoprazole 30 mg) for 7 days. Routine endoscopic exams or other evaluations were not performed to control treatment success before BS.

Post-operatively, individuals were classified according to the status of HP infection and success of the proposed eradication treatment into four groups: absence of infection (no HP infection before and after BS); successful eradication (presence of HP infection before and absence after BS); refractory infection (presence of HP infection before and after BS); and new-onset infection (absence of HP infection before and presence after BS).

Surgical technique

All surgical procedures were performed by the same team and followed the same technique. The main features of the RYGB were a 30-mL gastric pouch, a 100-cm biliopancreatic limb, and a 150-cm alimentary limb.

Pre-operative weight loss

All individuals operated on at this facility undergo a multidisciplinary pre-operative program which aims at promoting weight loss and healthier habits before BS. It comprises of weekly consultations with a complete multidisciplinary team (surgeon, nurse, psychologist, and dietitian), in which they receive general guidance, dietary advice and prescription, and general counseling. Individuals undergo BS after about 30 to 60 days, when they achieve an approximate 10 to 20% weight loss or when a minimum BMI close to 35 kg/m^2 is achieved[15].

Statistical analysis

To compare proportions, the chi-square test or Fisher's exact test was used, when necessary. The Mann-Whitney test was used to compare continuous measures between two independent groups or two evaluation moments. To compare continuous measures among three or more independent groups, the Kruskal-Wallis test was used; when significance was achieved, Tukey's post-test analysis was performed. The significance level adopted for the statistical tests was 5% (P<0.05). The analyses were carried out through the software SAS System for Windows (Statistic Analysis System), version 9.2 was used; SAS Institute Inc., 2002-2008, Cary, NC, USA.

RESULTS

The mean age was 39±11.2 years old and most of the individuals were female (87%). At surgery, the mean BMI was 36.2±3.6 kg/m^2; it significantly decreased to 26.7±3.3 kg/m^2 1 year after RYGB (P<0.0001). %TWL was 25.9±7.2% and %EWL was 89.4±31.7%.

Before BS, 55.4% of the participants had HP infection, while 27.7% had this infection after surgery. The reduction in the prevalence of infection was statistically significant (P=0.001). Regarding the status of HP infection and treatment success, it was observed that 33.8% never had HP infection, 38.5% had a successful treatment, 16.9% had refractory infection and 10.8 % had new-onset HP infection.

In regard to weight loss, %TWL was 27.3±7.5% in individuals who never had HP, 25.4±8.1% in the successfully treated, 25.7±5.2% in those with refractory infection, and 23.4±6.4% in the new-onset HP infection group; there were no significant differen-

ces among the four groups (P=0.6). Similarly, %EWL was 88.7±23.2% in individuals who never had HP, 94.5±41.5% in the successfully treated, 86.1±28.1% in those with refractory infection, and 78.5±18.4% in the new-onset HP group; %EWL did not significantly differ among the four groups (P=0.7).

Pre-operative HP infection significantly associated with the presence of gastritis (P=0.048). No other significant correlations were observed, either in relation to demographic, weight, and endoscopic variables. TABLE 1 shows the comparison between individuals with or without HP infection before RYGB.

Regarding the post-operative presence of HP infection, no significant associations were observed with any of the variables studied. TABLE 2 presents the complete comparison.

Comparing the groups classified according to the success of HP eradication therapy, it was observed that individuals with new-onset HP infections had a significantly lower frequency of jejunal erosions after surgery (P=0.048). TABLE 3 presents the complete comparison.

DISCUSSION

The current study showed a high prevalence of pre-operative HP infection in a population undergoing BS, as well as a significant rate of persistent post-operative HP infection, comprised of refractory and *"de novo"* cases. Furthermore, HP infection status did not significantly associate with post-RYGB weight loss outcomes. Pre-operative HP infection significantly associated with the occurrence of gastritis and post-operative new-onset HP infection was seemingly a protective factor against anastomotic jejunal erosions.

Despite the rise in the performance of BS over recent decades, there are scarce data on the prevalence of HP in individuals with obesity before and after the procedure and its possible role in post-operative weight loss, incidence of complications and occurrence of endoscopic abnormalities[16,17]. Wang et al.[18] reported that HP-infected individuals with gastritis had significantly less weight loss at a 24–48-month follow-up. However, the

TABLE 1. Comparison between individuals with or without HP infection before BS.

	HP infection	No HP infection	Value of *P*
N	36 (55.4%)	29 (44.6%)	NA
Age (years)	38.1±10.7	39.8±11.6	0.5
Gender	Male: 3 (8.3%) Female: 33 (91.7%)	Male: 5 (17.2%) Female: 24 (82.8%)	0.4
BMI at BS (kg/m^2)	36.4±2.7	36±4.2	0.6
Post-op BMI (kg/m^2)	26.8±3.7	26.7±2.6	0.9
%TWL	25.5±7.2	26.4±7.4	0.6
%EWL	91.9±37.9	86.2±22.2	0.5
Pre-op gastric ulcer	1 (2.8%)	0	1.0
Pre-op duodenal ulcer	0	0	1.0
Pre-op gastritis	**20 (55.6%)**	**9 (31%)**	**0.048**
Post-op gastritis	9 (25%)	5 (17.2%)	0.6
Post-op jejunal erosions	7 (19.4%)	10 (34.5%)	0.3
Post-op marginal ulcer	0	2 (6.7%)	0.2
Pre-op esophagitis	6 (16.7%)	5 (17.2%)	1.0
Post-op esophagitis	7 (19.4%)	5 (17.2%)	1.0

N: number of individuals; HP: Helicobacter pylori; BS: bariatric surgery; NA: not applicable; BMI: body mass index; %TWL: percentage of total weight loss; %EWL: percentage of excess weight loss. **Bold** indicates statistical significance.

TABLE 2. Comparison between individuals with or without HP infection after BS.

	HP infection	No HP infection	Value of *P*
N	18 (27.7%)	47 (72.3%)	NA
Age (years)	42.4±10.1	37.7±11.3	0.1
Gender	Male: 2 (11.1%) Female: 16 (88.9%)	Male: 6 (12.8%) Female: 41 (87.2%)	1.0
BMI at BS (kg/m^2)	36.4±3.1	36.1±3.4	0.8
Post-op BMI (kg/m^2)	27.4±3.1	26.5±3.3	0.3
%TWL	24.8±5.7	26.3±7.8	0.5
%EWL	83.2±24.4	91.8±34.1	0.3
Pre-op gastric ulcer	0	1 (2.1%)	1.0
Pre-op duodenal ulcer	0	0	1.0
Pre-op gastritis	10 (55.6%)	19 (40.4%)	0.4
Post-op gastritis	5 (27.8%)	9 (19.1%)	0.5
Post-op jejunal erosions	3 (16.7%)	14 (29.8%)	0.3
Post-op marginal ulcer	0	2 (4.3%)	1.0
Pre-op esophagitis	2 (11.1%)	9 (19.1%)	0.7
Post-op esophagitis	3 (16.7%)	9 (19.1%)	1.0

N: number of individuals; HP: *Helicobacter pylori;* BS: bariatric surgery; NA: not applicable; BMI: body mass index; %TWL: percentage of total weight loss; %EWL: percentage of excess weight loss.

TABLE 3. Comparison of study variables according with the HP infection status and sucess of eradication therapy.

	No HP infection	Successful eradication therapy	Refractory HP infection	New-onset HP infection	Value of P
N	22 (33.8%)	25 (38.5%)	11 (16.9%)	7 (10.8%)	NA
Age (years)	37.6±11.7	37.9±11.4	44.2±11.5	39.7±7.5	0.4
Gender	Male: 4 (18.2%) Female: 18 (81.8%)	Male: 2 (8%) Female: 23 (92%)	Male: 1 (9.1%) Female: 10 (90.9%)	Male: 1 (14.3%) Female: 6 (85.7%)	0.7
BMI at BS (kg/m^2)	36.5±2.8	35.7±4.5	36.7±2.8	35.9±2.8	0.8
Post-op BMI (kg/m^2)	26.5±2.7	26.5±3.8	27.3±3.7	27.5±2.3	0.8
%TWL	27.3±7.5	25.4±8.1	25.7±5.2	23.4±6.4	0.6
%EWL	88.7±23.2	94.5±41.5	86.1±28.1	78.5±18.4	0.7
Pre-op gastric ulcer	0	1 (4%)	0	0	1.0
Pre-op duodenal ulcer	0	0	0	0	1.0
Pre-op gastritis	6 (27.3%)	13 (52%)	7 (63.6%)	3 (42.9%)	0.2
Post-op gastritis	4 (18.2%)	5 (20%)	4 (36.4%)	1 (14.3%)	0.7
Post-op jejunal erosions	**10 (45.5%)**	**4 (16%)**	**3 (27.3%)**	**0**	**0.048**
Post-op marginal ulcer	0	2 (8%)	0	0	0.7
Pre-op esophagitis	4 (18.2%)	5 (25%)	1 (9.1%)	1 (14.3%)	0.9
Post-op esophagitis	4 (18.2%)	5 (25%)	2 (18.2%)	1 (14.3%)	1.0

N: number of individuals; HP: *Helicobacter pylori*; BS: bariatric surgery; NA: not applicable; BMI: body mass index; %TWL: percentage of total weight loss; %EWL: percentage of excess weight loss. **Bold** indicates statistical significance.

findings of the current study did not indicate an association between HP infection and weight loss.

As for the prevalence of HP infection in the population with obesity, Gonzalez-Heredia et al.[19] reported a prevalence of HP in approximately 17% of individuals with obesity, a frequency much lower than the observed in the present study (55%). Chaves et al.[20] described HP infection present in 40.7%, a proportion more comparable to that of the present study. Other studies report a highly variable prevalence of HP infection in pre-operative bariatric patients, with data ranging from 6.9 to 61.3%[21,22].

It has been debated whether HP is directly linked to significant metabolic changes related to obesity and insulin resistance because of the theory that the HP infection-associated chronic low-grade inflammation could influence these pathophysiological mechanisms. According to a systematic review carried out by Azami et al.[23], there is a relationship between the metabolic syndrome and insulin resistance with HP infection, as nine case-control studies confirmed this association. The suggested pathophysiology is the pro-inflammatory reaction through cytokines stimulated by the presence of HP, the production of oxygen free radicals, the change in the levels of ghrelin and leptin and the increase in the production of lipopolysaccharides by HP, known to be associated with inflammatory factors and chronic inflammation. These factors could co-jointly affect the gastrointestinal hormonal regulation of insulin and predispose to insulin resistance.

Moreover, a meta-analysis conducted by Valenzano et al.[24] and including 41 observational studies, recognized the tendency for HP infection to be more frequent in patients with diabetes. On the other hand, a large prospective study carried out by Zhou et al.[25] reported a lower risk of developing diabetes in individuals with HP. Therefore, evidence in this regard is still highly controversial and the currently available findings are conflicting.

Whether HP infection could exert any influence on weight loss outcomes after BS has been a topic of debate over recent years. Goday et al.[26] observed that HP treated patients had a greater reduction in BMI at 3 months after sleeve gastrectomy compared to individuals without HP infection. On the other hand, Shanti et al.[27] did not observe any difference in 3-month weight loss after sleeve gastrectomy in regard to HP infection. Rossetti et al.[28] also did not identify any difference in 12- and 24-month weight loss after sleeve gastrectomy between individuals with or without HP infection. Wang et al.[18] reported that patients with higher HP density experienced less %EWL 24 to 48 months follow-up after banded gastroplasty. A systematic review conducted by Mocanu et al.[2] found comparable rates of weight loss between HP-positive and HP-negative patients and concluded that HP associated with increased RYGB-related marginal ulceration rates, but had little to no impact on other BS outcomes. The current study also did not identify any influence of HP infection status on any weight loss outcome after RYGB.

In the current study, the HP eradication treatment led to an eradication rate close to 70%, while in the study carried out by Chaves et al.[20], this same scheme was successful in approximately 80%. Csendes et al.[29] found HP infection in 46.8% of patients before BS and in 31.6% afterward, even with the eradication therapy pre-operatively. In the present study, approximately 27.7% of had HP after BS, a number close to the described by Csendes et al.[29], reflecting a considerable number of refractory or new-onset infections. It is noteworthy that antimicrobial therapy for HP has been recently recommended to be warranted for 14 days, and no more 7 days, like it has been done in the current study population[30].

A review by Palermo et al.[31] reported that the presence of HP before BS might be related to the development of post-operative marginal ulcers and, thus, patients with upper gastrointestinal symptoms or even asymptomatic patients should rather undergo esophagogastroscopy before BS and treated for HP infection when present. However, some authors point out that the prevalence of HP infection in patients undergoing BS is like that of the general population, and that the investigation of this bacterium as well as its pre-operative treatment does not reduce the incidence of anastomotic ulcer or gastritis in the gastric pouch[32,33]. There was no association of HP infection with marginal ulcer in the present study.

Interestingly, it was found in the current study that new-onset HP infection was a protective factor against the occurrence of juxta-anastomotic jejunal erosions. This finding was unexpected and, to our best knowledge to date, unprecedented. This also raises some questions on the nature of the rela-

tionship between HP and humans, which has been increasingly questioned, with hypotheses ranging from parasitism to some degree of symbiosis. There are reports of HP-mediated protection against inflammatory bowel disease, as well as lower rates of enteritis in individuals with HP infection[32]. Several mechanisms are suggested for this, such as the influence of HP on the microflora of the gastrointestinal tract and the immune response to HP carried out by regulatory T-cells, a suppressive subtype of CD4+ T-cells. These mechanisms could generate a lower inflammatory response in the small intestine and, thus, be linked to some degree of protection against jejuna erosions[34,35]. Maeda et al.[36] had previously hinted at this possible protective effect of HP on the small bowel mucosa against external injuries or inflammatory damage.

This study has some limitations that should be taken into consideration. Its retrospective design may associate with data of lower quality. Its small sample and low number of post-operative examinations do not also permit ultimate conclusions and prompt extrapolations. As the post-operative esophagogastroscopies were not routinely performed, this might lead to some degree of selection bias. The selective performance of post-operative esophagogastroscopies also compromised the population sample of the current study. Nonetheless, its findings are of interest and deserve further investigation, especially by means of larger prospective studies.

CONCLUSION

No effects of the HP infection status on weight loss were identified in individuals undergoing RYGB. A higher prevalence of gastritis was observed in individuals with HP infection before BS. New-onset HP infection after BS was a protective factor for jejunal erosions.

Authors' contribution

Sia GB: data curation; investigation; visualization; writing – original draft. Gestic MA, Utrini MP and Chaim FDM: data curation; investigation; visualization; supervision. Chaim EA: data curation; investigation; visualization; resources. Cazzo E: conceptualization; methodology; formal analysis; writing – review and editing.

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Sia GB, Gestic MA, Utrini MP, Chaim FDM, Chaim EA, Cazzo E. A infecção por *Helicobacter pylori* e o resultado de seu tratamento de erradicação influenciam a perda de peso e achados endoscópicos após o bypass gástrico em Y de Roux? Um estudo de coorte histórica. Arq Gastroenterol. 2023;60(1):57-64.

RESUMO – Contexto – Há evidências conflitantes na literatura atual ligando a infecção por *Helicobacter pylori* (HP) com a perda de peso e achados endoscópicos após o *bypass* gástrico em Y de Roux (BGYR). **Objetivo –** Identificar correlações entre infecção por *Helicobacter pylori* HP e seu tratamento de erradicação com perda de peso e achados endoscópicos após BGYR. **Métodos –** Trata-se de um estudo retrospectivo e observacional de coorte histórica, baseado em um banco de dados coletados prospectivamente de indivíduos submetidos ao BGYR de 2018 a 2019 em um hospital terciário universitário. A infecção pelo HP e os resultados da terapia de erradicação do HP foram correlacionados com a perda de peso pós-operatória e os achados endoscópicos. Os indivíduos foram classificados de acordo com o status de infecção pelo HP em quatro grupos: ausência de infecção; erradicação bem-sucedida; infecção refratária; e infecção nova. **Resultados –** Dos 65 indivíduos, 87% eram do sexo feminino e a média de idade foi de 39±11,2 anos. O índice de massa corporal diminuiu significativamente de 36,2±3,6 para 26,7±3,3 kg/m² um ano após BGYR (P<0,0001). O percentual de perda de peso foi 25,9±7,2% e o percentual de perda do excesso de peso foi 89,4±31,7%. A prevalência de infecção por HP diminuiu de 55,4% para 27,7% após a cirurgia (P=0,001); 33,8% nunca tiveram infecção por HP, 38,5% tiveram um tratamento bem-sucedido, 16,9% tiveram infecção refratária e 10,8% tiveram nova infecção por HP. Infecção pré-operatória por HP associou-se significativamente à presença de gastrite (P=0,048). Infecções por HP de início recente associaram-se significativamente com menor frequência de erosões jejunais após a cirurgia (P=0,048). **Conclusão –** Não foram identificados efeitos da infecção por HP na perda de peso em indivíduos submetidos ao BGYR. Maior prevalência de gastrite foi observada em indivíduos com infecção por HP antes da cirurgia. A infecção por HP de início recente após BGYR foi um fator protetor para erosões jejunais.

Palavras-chave – *Helicobacter pylori*; derivação gástrica; obesidade; cirurgia bariátrica; perda de peso.

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