

FUNDOPPLICATION CONVERSION IN ROUX-EN-Y GASTRIC BYPASS FOR CONTROL OF OBESITY AND GASTROESOPHAGEAL REFLUX: SYSTEMATIC REVIEW

Conversão de fundoplicatura em bypass gástrico em Y-de-Roux para controle da obesidade e do refluxo gastroesofágico: revisão sistemática

Antônio Moreira **MENDES-FILHO¹**, Eduardo Sávio Nascimento **GODOY¹**, Helga Cristina Almeida Wahnon **ALHINHO¹**, Manoel dos Passos **GALVÃO-NETO²**, Almino Cardoso **RAMOS²**, Álvaro Antônio Bandeira **FERRAZ^{1,3}**, Joseemberg Marins **CAMPOS^{1,3}**.

From the ¹Programa de Pós-Graduação em Cirurgia, Universidade Federal de Pernambuco, Recife, PE; ²Clínica Gastro Obeso Center, São Paulo, SP; ³Departamento de Cirurgia e Medicina Clínica, Universidade Federal de Pernambuco, Recife, PE ("Post-Graduation Program in Surgery, Federal University of Pernambuco, Recife, PE; ² Gastro Obeso Center Clinic, São Paulo, SP; ³Department of Surgery and Clinical Medicine, Federal University of Pernambuco, Recife, PE), Brazil

HEADINGS - Bariatric surgery. Gastroesophageal reflux. Gastric bypass. Fundoplication. Laparoscopy.

Correspondence:
Antônio Moreira Mendes Filho
E-mail: moreiraantonio6@gmail.com

Financial source: none
Conflict of interest: none

Received for publication: 11/05/2017
Accepted for publication: 21/09/2017

DESCRITORES - Cirurgia bariátrica. Refluxo gastroesofágico. Derivação gástrica. Fundoplicatura. Laparoscopia.

ABSTRACT - Introduction: Obesity is related with higher incidence of gastroesophageal reflux disease. Antireflux surgery has inadequate results when associated with obesity, due to migration and/or subsequent disruption of antireflux wrap. Gastric bypass, meanwhile, provides good control of gastroesophageal reflux. **Objective:** To evaluate the technical difficulty in performing gastric bypass in patients previously submitted to antireflux surgery, and its effectiveness in controlling gastroesophageal reflux. **Methods:** Literature review was conducted between July to October 2016 in Medline database, using the following search strategy: ("Gastric bypass" OR "Roux-en-Y") AND ("Fundoplication" OR "Nissen") AND ("Reoperation" OR "Reoperative" OR "Revisional" OR "Revision" OR "Complications"). **Results:** Were initially classified 102 articles; from them at the end only six were selected by exclusion criteria. A total of 121 patients were included, 68 women. The mean preoperative body mass index was 37.17 kg/m² and age of 52.60 years. Laparoscopic Nissen fundoplication was the main prior antireflux surgery (70.58%). The most common findings on esophagogastroduodenoscopy were esophagitis (n=7) and Barrett's esophagus (n=6); the most common early complication was gastric perforation (n=7), and most common late complication was stricture of gastrojejunostomy (n=9). Laparoscopic gastric bypass was performed in 99 patients, with an average time of 331 min. Most patients had complete remission of symptoms and efficient excess weight loss. **Conclusion:** Although technically more difficult, with higher incidence of complications, gastric bypass is a safe and effective option for controlling gastroesophageal reflux in obese patients previously submitted to antireflux surgery, with the added benefit of excess weight loss.

RESUMO - Introdução: Obesidade está relacionada à maior incidência de doença do refluxo gastroesofágico. Cirurgia antirreflujo apresenta resultados inadequados quando associada à obesidade, devido à migração e/ou ruptura posterior da válvula antirreflujo. Bypass gástrico enquanto isso determina bom controle de refluxo gastroesofágico. **Objetivo:** Avaliar a dificuldade técnica na realização de bypass gástrico em pacientes previamente submetidos à cirurgia antirreflujo, e sua eficácia no controle do refluxo gastroesofágico. **Método:** Revisão de literatura foi realizada entre os meses de julho a outubro de 2016, na base de dados Medline, com a seguinte estratégia de busca: ("Gastric Bypass" OR "Roux-en-Y") AND ("Fundoplication" OR "Nissen") AND ("Reoperation" OR "Reoperative" OR "Revisional" OR "Revision" OR "Complications"). **Resultados:** Foram inicialmente classificados 102 artigos selecionando-se, por critérios de exclusão, apenas seis ao final. Foram incluídos 121 pacientes, sendo 68 mulheres. A média de índice de massa corporal pré-operatório foi 37,17 kg/m² e idade de 52,60 anos. Fundoplicatura de Nissen laparoscópica foi a principal operação antirreflujo prévia (70,58%). Os achados mais comuns na endoscopia digestiva alta foram esofagite (n=7) e esôfago de Barrett (n=6); a complicação precoce mais comum foi perfuração gástrica (n=7), e tardia, estenose de anastomose gastrojejunal (n=9). Bypass laparoscópico foi realizado em 99 pacientes, com tempo médio de 331 min. A grande maioria dos pacientes apresentou completa remissão dos sintomas e perda eficiente do excesso de peso. **Conclusão:** Apesar de tecnicamente mais difícil, com maior incidência de complicações, o bypass gástrico é opção segura e efetiva no controle do refluxo gastroesofágico em pacientes obesos previamente submetidos à operação antirreflujo, com a vantagem adicional da perda do excesso de peso.

INTRODUCTION

Gastroesophageal reflux disease (GERD) has a prevalence estimated between 20-40% in the USA and Europe and 12% in Brazil^{6,14,15,22}. Obesity is a frequently associated condition, due to an increase in abdominal pressure with consequent hypotonia of the lower esophageal sphincter, and increase in the frequency of its spontaneous relaxation^{1,3,5,10,19,20}. The surgical treatment of GERD has regained space with the advent of laparoscopy. However,

the results in obese patients are deficient, and partial or total rupture and even migration of the anti-reflux valve may occur¹³. On the other hand, gastric bypass (GB), a surgery widely used to treat morbid obesity, has excellent results in the control of gastroesophageal reflux⁸. In recent years, it has become an alternative for recurrence of GERD after fundoplication, although it is associated with greater difficulties and complications^{11,14}.

This systematic review aims to evaluate the efficacy and safety, analyzing the technical difficulties and complications of GB in the control of GERD, in patients previously submitted to antireflux surgery.

METHODS

Search strategy

A systematic review of the literature was performed from July to August 2016 in the Medline database, using the following cross-referencing of Boolean terms and headings: ("Gastric bypass" OR "Roux-en-Y") AND ("Nissen") AND ("Reoperation" OR "Reoperative" OR "Revision" OR "Complications").

Articles selection

Inclusion criteria

Full original articles were searched, published in English, from 1995 to 2016, in which GB was used to treat GERD recurrence after antireflux operation

Exclusion criteria

Case reports (or series), review articles and articles with the use other surgical techniques were excluded.

Evaluated variables

The number of patients operated, operative time, hospitalization time and reported complications were the extracted data (Table 1).

Selected papers

One hundred and two articles were found with the search strategy; 88 were initially excluded by title and abstract. Of the remaining 14, eight were excluded after reading the full text, as they did not meet the inclusion criteria, resulting in a final number of six articles^{11,12,13,14,17,22}. Figure 1 illustrates the research strategy

TABLE 1 - Data extracted from each study

Autor	n	Funduplicatura prévia	Achados EGD	Válvula à EGD	Tipo Bypass	IMC pré-operatório (Kg/m ²)	Tempo de Operação (minutos)	Tempo de Internamento (dias)	IMC pós-operatório (Kg/m ²)	Remissão dos sintomas	Uso de Medicação Anti-refluxo
Raftopoulos I et al. 2004	7	4 LNF 2LNCF 1 ONF	1 refluxo 1 gastrite 1 obstrução da JGE 1 estenose de JGE	4 intactas 3 hérnias hiatais (1 deslizamento torácico)	7LGBP	37,5	372(206-523)	4,8 (3-8)	26,8	Total: 1/7 Parcial: 6/7	Nenhuma: 3/7 IBP: 3 BH2:1
Houghton SG et al. 2005	19	10 LNF 7 ONF 1 Nissen 1 transtoracica 1 Toupet	3 esofagite 2 Barrett 1 erosão Cameron	9 intactas 4 hérnias hiatais recorrentes 1 "slipped Nissen"	170GB 2LGB	42	NR	7	32 +2	Total: 18/18	Nenhuma: 18/18
Kellogg TA et al. 2007	11	8 LNF 3 ONF	4 esofagite erosiva	NR	11 LGB	44	349(222-624)	3,4 (2-6)	30,2	Total: 7/9 Parcial: 2/9	NR
IbeleAetal. 2012	14	14 LNF	NR	NR	14LGBP	43,5	160(120-240)	5,1 (1-17)	NR	Total: 14/14	Nenhuma: 8/10 IBP 2/10
Stefanidis D et al. 2012	25	NR	NR	14 hérnias hiatais 7 rupturas	24 LGB 10GB	34,4	345(180-600)	7(2-30)	60% do sobrepeso	Total: 24/25 Parcial: 1/25	NR
Kim Metal. 2014	45	NR	4 Esôfago de Barrett	9 rupturas 25 hérnias hiatais	41 LGB 4 0GB	33	367(190-600)	4(1-33)	52,6% do sobrepeso	Total: 42/45 Parcial: 3/45	NR

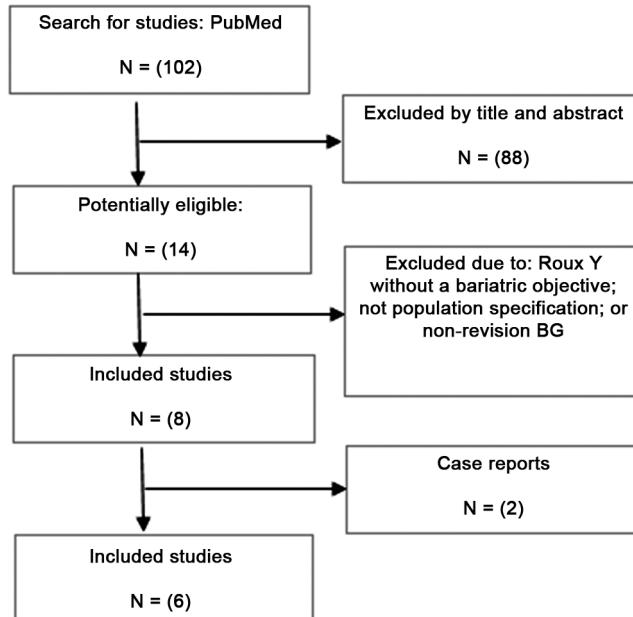


FIGURE 1 - Systematic review flowchart

RESULTS

Characteristics of the studies

Six were selected for analysis, comprising 121 patients. Published papers were from the USA. Publication date ranged from 2004 to 2014.

Characteristics of the patients (n=121)

Four of the six studies reported the first surgical technique: 36 laparoscopic Nissen funduplications (70.58%); 11 laparoscopic Nissen funduplications (21.56%); two laparoscopic Nissen-Collis fundoplication (3.92%); one transthoracic Nissen fundoplication (1.96%); and one Toupet fundoplication (1.96%). In the rest (n=70) no information about performed technique was found. The mean preoperative body mass index (BMI) was 37.17 kg/m² (21.6-50.6 kg/m²), with a mean age of 52.60 years (25-74). Five studies reported gender of the patients: 68 patients were women (89.47%) and eight men (10.53%). Table 2 presents the anthropometric data.

TABLE 2 - Anthropometric data

Number of patients	121
BMI - mean (kg/m ²)	37.17 (21.6 – 50.6)
Age - average (years)	52.60 (25 – 74)
Gender (reported in five studies)	89.47% F / 10.53% M

Preoperative upper gastrointestinal endoscopy findings

It was performed and reported in 96 patients; all, except one study, reported the status of the fundoplication valve: seven had intact wrap; 21 with ruptures; one slip; one partial herniation; one herniation with slip; and one distorted. There were also 46 hiatal hernias.

The most frequent endoscopic alterations were esophagitis (n=7) and Barrett's esophagus (n=6). Reflux, gastritis, gastroesophageal junction obstruction, gastroesophageal junction stenosis and Cameron lesions were also found, with one case each.

Revisonal operation

All studies reported the revisonal operation approach. The majority was submitted to laparoscopic GB (n=99) and 22 to laparotomic GB (81.81% vs. 18.18%). The mean surgical time was 331 min (180-624) and the mean length of hospital stay was 5.21 days (1-33).

Complications

They were classified as precocious (≤ 30 days) or late (> 30 days) in four studies.

The most common precocious was gastric perforation (n=7), followed by intestinal obstruction (n=4), operative wound infection (n=4), fistula in gastrojejunral anastomosis (n=3), hemorrhage (n=2), pulmonary embolism (n=2), splenectomy (n=1), pressure ulcer (n=1) and pneumonia (n=1, Table 3).

TABLE 3 - Early complications

Complication	n (%)
Gastric perforation	7 (5.78)
Bowel obstruction	4 (3.30)
Surgical wound infection	4 (3.30)
Leakage of gastrojejunral anastomosis	3 (2.48)
Bleeding	3 (2.48)
Esophageal perforation	2 (1.65)
Pulmonary embolism	2 (1.65)
Splenectomy	1 (0.83)
Pressure ulcer	1 (0.83)
Pneumonia	1 (0.83)

The treatment of gastric perforation was detailed: in six cases was located at the fundus and resected at the gastrectomy; in one was repaired with suture, without sequelae. In relation to the two esophageal perforations, one was treated with gastric fundus patch; in the other no treatment details were mentioned²³.

The most common late complications were gastrojejunral anastomotic stenosis (n=9), gastrojejunral fistulae (n=2), intestinal obstruction (n=4), gastrocutaneous fistula (n=2), marginal ulcer (n=2), gastrojejunral obstruction (n=2), gastrojejunral bleeding (n=2), perforation of duodenal diverticulum (n=2), respiratory failure (n=2), gastric herniation (n=1), internal hernia (n=1), pneumonia (n=1), nausea (n=1), vomiting (n=1), melena (n=1) and prolonged mechanical ventilation (n=1, Table 4).

The treatment of gastrojejunral stenosis was reported in all cases. Balloon dilatation was the endoscopic procedure of choice, with success in all patients; in one case there was also a need for gastrostomy feeding through the stomach excluded because of concomitant gastrocutaneous fistula, which was resolved with the treatment¹¹. The number of dilatations was reported in six patients, with an average of 3.5 (range of 1-6 sessions). The two patients who presented fistula in the gastrojejunral anastomosis were reoperated, but the techniques were not detailed^{14,22}.

TABLE 4 - Late complications

Complication	n (%)
Gastrojejunral anastomosis stenosis	9 (7.44)
Bowel obstruction	4 (3.31)
Leakage of gastrojejunral anastomosis	2 (1.65)
Gastrocutaneous fistula	2 (1.65)
Marginal ulcer	2 (1.65)
Gastrojejunral obstruction	2 (1.65)
Gastrojejunral bleeding	2 (1.65)
Perforation of duodenal diverticulum	2 (1.65)
Respiratory insufficiency	2 (1.65)
Gastric herniation	1 (0.83)
Internal hernia	1 (0.83)
Cholecystitis	1 (0.83)
Pneumonia	1 (0.83)
Nausea	1 (0.83)
Vomiting	1 (0.83)
Melena	1 (0.83)
Prolonged mechanical ventilation	1 (0.83)

Efficacy in controlling GERD

Regarding the efficacy of GB in the management of GERD, among the 118 patients who remained on follow-up, 106 presented total remission of GERD symptoms (89.8%), while the remaining 12 showed partial improvement (10.2%)^{11,12,13,14,17,22}. Three studies reported maintenance of antireflux medications: of the 35 patients who used these drugs in the preoperative period, 29 no longer used (82.9%) and six maintained the use (17.1%)^{11,12,17}.

DISCUSSION

Many authors have already reported the poor outcome of the antireflux operation in obese patients, with valve migration or rupture in most cases^{13,16,22,24}; others demonstrated different results, with similar efficacy to those performed on normal weight subjects. However, the latter have limitations in relation to the number of patients, follow-up period and the fact that most individuals were carriers of mild obesity^{7,24}. GB has become the treatment of choice for GERD in this situation; its good results come from the fact that the small pouch contains few acid producing parietal cells and that the long alimentary loop (usually 1 m) prevents the return of biliopancreatic content².

Bariatric revision procedures are more complex^{18,26}, with fundoplication for GB being the group of higher risk when compared to the gastric band for vertical gastrectomy and gastric band for GB²¹. This in patients with anterior fundoplication has more technical difficulties, longer operative time and postoperative morbidity, both early and late period^{9,21}. The technical difficulty of the revisional GB was well reported in the case-control study of Ibele et al.¹². The revision was compared to GB without prior antireflux operation, with higher complication rates in the first group.

The technical difficulties usually reported are due to the occurrence of strong adhesions between liver and stomach, as well as the need to undo the anterior fundoplication region, to avoid making gastric pouch septa. This stage is responsible for the most common early postoperative complication: gastric perforation (n=7). All cases were treated by gastric fundus resection during GB, except one, in which the perforation was sutured^{14,22}.

Gastrojejunral anastomosis stenosis was the late complication most reported in this review (n=9). It was more frequent in Raftopoulos et al report, occurring in five of the seven patients; these authors justified the fact due to the inclusion of patients already submitted to dilations in previous procedures (funduplications and fundoplication redo)¹⁷. However, all were successfully treated with endoscopic dilation^{11,12,17}.

Ibele et al. suggested maintaining fundoplication intact as an alternative to decrease the incidence of complications;

however, the authors themselves question the option of not allowing adequate control of GERD or determining unsatisfactory weight loss¹².

In a retrospective study, Kim et al. presented the initial results of the robotic technique (n=13), reporting a better intraoperative visualization as a possible advantage over traditional laparoscopic surgery, facilitating the dissection of hyaline adhesions and anterior fundoplication release; new studies are needed with this technique to assess whether there will be an impact on the reduction of complications¹⁴.

Laparoscopic approach was performed in 17 patients in the Houghton et al. series; however, it was associated with an extended hospital stay (seven days) and a complication rate of approximately 21%¹¹.

The redo fundoplication technique, indicated by some authors as an alternative to the initial fundoplication failure²³ shows inadequate results, with failure rates above 60% in 10 years⁴. Kim et al. reported GB patients who had undergone three previous funduplications.

Weight gain after initial antireflux operation was identified as the main cause of failure and reported in all included articles; the majority of patients undergoing the new procedure had grade I obesity (some grade II); all authors pointed to the efficient excess weight loss after GB as an additional advantage^{12,13,14,17,22,25}.

CONCLUSION

Despite a higher rate of postoperative complications, GB is a safe and effective option to control GERD after the failure of the antireflux operation in obese patients, with the additional advantage of losing excess weight.

REFERENCES

- Ayazi S, Hagen JA, Zehetner J, Ross O, Wu C, Oezcelik A, Abate E, Sohn HJ, Banki F, Lipham JC, DeMeester SR, Demeester TR. The value of high-resolution manometry in the assessment of the resting characteristics of the lower esophageal sphincter. *J Gastrointest Surg*. 2009 Dec;13(12):2113-20. doi: 10.1007/s11605-009-1042-0. Epub 2009 Sep 25. PubMed PMID: 19779945.
- Berger EH (1934) The distribution of parietal cells in the stomach: a histotopographic study. *Am J Anat* 54: 87-114.
- Biccias BN, Lemme EM, Abrahão LJ Jr, Aguero GC, Alvariz A, Schechter RB. [Higher prevalence of obesity in erosive gastroesophageal reflux disease]. *Arq Gastroenterol*. 2009 Jan-Mar;46(1):15-9. Portuguese. PubMed PMID: 19466304.
- Dallemande B, Arenas Sanchez M, Francart D, Perretta S, Weerts J, Markiewicz S, Jehaes C. Long-term results after laparoscopic reoperation for failed antireflux procedures. *Br J Surg*. 2011 Nov;98(11):1581-7. doi: 10.1002/bjs.7590. Epub 2011 Jun 28. PubMed PMID: 21710482.
- El-Serag HB, Kvapil P, Hacken-Barter J, Kramer JR. Abdominal obesity and the risk of Barrett's esophagus. *Am J Gastroenterol*. 2005 Oct;100(10):2151-6. PubMed PMID: 16181362.
- El-Serag HB, Sonnenberg A. Associations between different forms of gastro-oesophageal reflux disease. *Gut*. 1997 Nov;41(5):594-9. PubMed PMID: 9414963. PubMed Central PMCID: PMC1891561.
- Fraser J, Watson DI, O'Boyle CJ, Jamieson GG. Obesity and its effect on outcome of laparoscopic Nissen fundoplication. *Dis Esophagus*. 2001;14(1):50-3. PubMed PMID: 11422306.
- Frezza EE, Ikramuddin S, Gourash W, Rakitt T, Kingston A, Luketich J, Schauer P. Symptomatic improvement in gastroesophageal reflux disease (GERD) following laparoscopic Roux-en-Y gastric bypass. *Surg Endosc*. 2002 Jul;16(7):1027-31. Epub 2002 May 3. PubMed PMID: 11984683.
- Gilmore MM, Kallies KJ, Mathias MA, Kothari SN. Varying marginal ulcerates in patients undergoing laparoscopic Roux-en-Y gastric bypass for morbid obesity versus gastroesophageal reflux disease: is the acid pocket to blame? *Surg Obes Relat Dis*. 2013 Nov-Dec;9(6):862-6. doi: 10.1016/j.soird.2013.01.017. Epub 2013 Feb 6. PubMed PMID: 23522621.
- Herbella FA, Sweet MP, Tedesco P, Nipomnicki L, Patti MG. Gastroesophageal reflux disease and obesity. Pathophysiology and implications for treatment. *J Gastrointest Surg*. 2007 Mar;11(3):286-90. PubMed PMID: 17458599.
- Houghton SG, Nelson LG, Swain JM, Nesset EM, Kendrick ML, Thompson GB, Murr MM, Nichols FC, Sarr MG. Is Roux-en-Y gastric bypass safe after previous antireflux surgery? Technical feasibility and postoperative symptom assessment. *Surg Obes Relat Dis*. 2005 Sep-Oct;1(5):475-80. Epub 2005 Aug 31. PubMed PMID: 16925273.
- Ibele A, Garren M, Gould J. The impact of previous fundoplication on laparoscopic gastric bypass outcomes: a case-control evaluation. *Surg Endosc*. 2012 Jan;26(1):177-81. doi: 10.1007/s00464-011-1851-6. Epub 2011 Aug 20. PubMed PMID: 21858578.
- Kellogg TA, Andrade R, Maddaus M, Slusarek B, Buchwald H, Ikramuddin S. Anatomic findings and outcomes after antireflux procedures in morbidly obese patients undergoing laparoscopic conversion to Roux-en-Y gastric bypass. *Surg Obes Relat Dis*. 2007 Jan-Feb;3(1):52-7; discussion 58-9. Epub 2006 Nov 20. PubMed PMID: 17116426.
- Kim M, Navarro F, Erchulu CN, Augenstein VA, Heniford BT, Stefanidis D. Minimally invasive Roux-en-Y gastric bypass for fundoplication failure offers excellent gastroesophageal reflux control. *Am Surg*. 2014 Jul;80(7):696-703. PubMed PMID: 24987903.
- Nasi A, de Moraes-Filho JP, Cecconello I. [Gastroesophageal reflux disease: an overview]. *Arq Gastroenterol*. 2006 Oct-Dec;43(4):334-41. Review. Portuguese. PubMed PMID: 17406765.
- Patterson EJ, Davis DG, Khajanchee Y, Swanström LL. Comparison of objective outcomes following laparoscopic Nissen fundoplication versus laparoscopic gastric bypass in the morbidly obese with heartburn. *Surg Endosc*. 2003 Oct;17(10):1561-5. Epub 2003 Jul 21. PubMed PMID: 12874685.
- Raftopoulos I, Awais O, Courcoulas AP, Luketich JD. Laparoscopic gastric bypass after antireflux surgery for the treatment of gastroesophageal reflux in morbidly obese patients: initial experience. *Obes Surg*. 2004 Nov-Dec;14(10):1373-80. PubMed PMID: 15603654.
- Sampaio-Neto J, Branco-Filho AJ, Nassif LS, Nassif AT, Masi FD, Gasperin G. Proposal of a revisional surgery to treat severe nutritional deficiency post-gastric bypass. *Arq Bras Cir Dig*. 2016;29 Suppl 1(Suppl 1):98-101. doi: 10.1590/0102-6720201600S10024. English, Portuguese. PubMed PMID: 27683787; PubMed Central PMCID: PMC5064252.
- Santo MA, Quintanilha SR, Mietti CA, Kawamoto FM, Marson AG, de Cleva R. Endoscopic changes related to gastroesophageal reflux disease: comparative study among bariatric surgery patients. *Arq Bras Cir Dig*. 2015;28 Suppl 1:36-8. doi: 10.1590/S0102-6720201500S100011. English, Portuguese. PubMed PMID: 26537271; PubMed Central PMCID: PMC4795304.
- Santos TD, Burgos MG, de Lemos Mda C, Cabral PC. Clinical and nutritional aspects in obese women during the first year after roux-en-y gastric bypass. *Arq Bras Cir Dig*. 2015;28 Suppl 1:56-60. doi: 10.1590/S0102-6720201500S100016. English, Portuguese. PubMed PMID: 26537276; PubMed Central PMCID: PMC4795309.
- Stefanidis D, Malireddy K, Kuwada T, Phillips R, Zoog E, Gersin KS. Revisional bariatric surgery: perioperative morbidity is determined by type of procedure. *Surg Endosc*. 2013 Dec;27(12):4504-10. doi: 10.1007/s00464-013-3097-y. Epub 2013 Aug 14. PubMed PMID: 23943144.
- Stefanidis D, Navarro F, Augenstein VA, Gersin KS, Heniford BT. Laparoscopic fundoplication takedown with conversion to Roux-en-Y gastric bypass leads to excellent reflux control and quality of life after fundoplication failure. *Surg Endosc*. 2012 Dec;26(12):3521-7. doi: 10.1007/s00464-012-2380-7. Epub 2012 Jun 13. PubMed PMID: 22692463.
- Wakeam E, Wee J, Lebenthal A, Ali SO, Gilbert RJ, Bueno R. Does BMI predict recurrence or complications after reoperative reflux surgery? Review of a single center's experience and a comparison of outcomes. *J Gastrointest Surg*. 2014 Nov;18(11):1965-73. doi: 10.1007/s11605-014-2656-4. Epub 2014 Sep 17. PubMed PMID: 25227639.
- Winslow ER, Frisella MM, Soper NJ, Klingensmith ME. Obesity does not adversely affect the outcome of laparoscopic antireflux surgery (LARS). *Surg Endosc*. 2003 Dec;17(12):2003-11. Epub 2003 Oct 28. PubMed PMID: 14577029.
- Zainabadi K, Courcoulas AP, Awais O, Raftopoulos I. Laparoscopic revision of Nissen fundoplication to Roux-en-Y gastric bypass in morbidly obese patients. *Surg Endosc*. 2008 Dec;22(12):2737-40. doi: 10.1007/s00464-008-9848-5. Epub 2008 Mar 25. PubMed PMID: 18363066.
- Zorron R, Galvão-Neto MP, Campos J, Branco AJ, Sampaio J, Junghans T, Bothe C, Benzing C, Krenzien F. FROM COMPLEX EVOLVING TO SIMPLE: CURRENT REVISIONAL AND ENDOSCOPIC PROCEDURES FOLLOWING BARIATRIC SURGERY. *Arq Bras Cir Dig*. 2016;29 Suppl 1(Suppl 1):128-133. doi: 10.1590/0102-6720201600S10031. English, Portuguese. PubMed PMID: 27683794; PubMed Central PMCID: PMC5064255.