

Prevalence and Clinical Impact of Abnormal Findings in Routine Upper Digestive Endoscopy Before Bariatric Surgery

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Rezumat

Prevalența și impactul clinic al leziunilor obiectivate prin endoscopie digestivă superioară preoperatorie în chirurgia bariatrică

Context: Rolul endoscopiei digestive superioare preoperatorii în chirurgia bariatrică rămâne unul controversat. Acest studiu își propune să evalueze prevalența leziunilor obiectivate endoscopic și impactul lor clinic la pacienții obezi cu indicație pentru intervenții chirurgicale bariatrice.

Metode: A fost efectuat un studiu observațional retrospectiv al tuturor pacienților la care s-a practicat endoscopie digestivă superioară înainte de operația bariatrică în perioada ianuarie 2019 – decembrie 2021.

Rezultate: Au fost identificați un total de 612 pacienți, majoritatea femei (79,2%), cu vârsta medie de 43,9 ani. Diferite tipuri de leziuni au fost identificate la 474 (77,5%) pacienți, incluzând gastropatie eritematoasă (59,2%), esofagită de reflux (13,6%), gastrită erozivă (10,6%) și hernie hiatală (8,0%). În 4 cazuri a fost identificat esofagul Barrett și un pacient a fost diagnosticat cu adenocarcinom gastric. Tuturor pacienților li s-au recoltat biopsii gastrice care au evidențiat gastrită cu *H. pylori* în 368 cazuri (60,1%). Evidențierea endoscopică a leziunilor macroscopice și examinarea histologică au influențat managementul perioperator la 403 (65,8%) pacienți, cu ajustarea tratamentului medicamentos preoperator la 378 pacienți (61,8%) și tratamentul endoscopic al leziunilor mucoasei la 47 pacienți (7,7%); în 27 cazuri (7,8%), strategia chirurgicală a fost direct influențată de endoscopia preoperatorie și în cazul unui pacient (0,2%) s-a stabilit contra-indicația pentru efectuarea intervenției chirurgicale bariatrice.

Concluzie: Endoscopia digestivă superioară preoperatorie identifică o gamă largă de leziuni la pacienții obezi, care influențează adesea managementul perioperator. Prin urmare,

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trebuie luată în considerare efectuarea acesteia la toți pacienții înainte de intervenția chirurgicală bariatrică.

Cuvinte cheie: endoscopie digestivă superioară, chirurgie bariatrică, obezitate

Abstract:

Background: The role of preoperative upper digestive endoscopy has been discussed with controversy in bariatric surgery. This study aims to evaluate the prevalence of endoscopic findings in obese patients undergoing bariatric surgery and their clinical impact.

Methods: A retrospective observational study of all patients who performed upper endoscopy before bariatric surgery between January 2019 and December 2021 was performed.

Results: A total of 612 patients were identified, mostly females (79.2%), with a mean age of 43.9 years. Abnormal endoscopic findings were identified in 474 (77.5%) patients, including erythematous gastropathy (59.2%), reflux esophagitis (13.6%), erosive gastritis (10.6%), and hiatal hernia (8.0%). Importantly, Barrett's esophagus was also identified in four patients and gastric adenocarcinoma in one. All performed gastric biopsies that revealed *H. pylori* gastritis in 368 (60.1%). Taken together, abnormal endoscopic and histological findings influenced perioperative management of 403 (65.8%) patients, including preoperative medical therapy in 378 (61.8%), endoscopic treatment of mucosal lesions in 47 (7.7%), direct influence in surgical strategy in 27 (7.8%) and contraindication to bariatric surgery in 1 (0.2%).

Conclusion: Preoperative upper endoscopy identifies a wide range of abnormal findings in obese patients, which often influence peri-operative management. Therefore, it must be considered in all patients prior to bariatric surgery.

Key words: upper digestive endoscopy, obesity, bariatric surgery

Introduction

Obesity is a global public health problem that currently affects approximately 30% of the world population, more than 2 billion people (1). The increase in obesity incidence rates over the past three decades has been remarkable both in developed and developing countries due to changes in consumption patterns and lifestyle habits and current trends suggest that its global prevalence will rise to 60% in men, 40% in women and 25% in children by 2050 (2). This will carry a profound health burden with substantial impact on healthcare expenditure (3).

Surgery has gained popularity as an interesting approach for obese patients who are not able to lose weight with diet and

lifestyle changes, with approximately 250.000 procedures performed annually in the United States (4). Modern bariatric procedures have demonstrated strong evidence of efficacy and safety, and are currently recommended for patients with body mass index (BMI) >40 kg/m², BMI >35-40 kg/m² with associated comorbidities or BMI >30-35 kg/m² and diabetes mellitus and/or hypertension refractory to optimal medical therapy (5).

Routine upper digestive endoscopy is currently recommended as part of the preoperative work-up for all obese patients who are candidates for bariatric surgery (5). However, it is still controversial whether or not to routinely screen all patients before surgery. Some researchers recommend a selective strategy toward routine upper digestive

endoscopy, as most lesions identified in asymptomatic patients demonstrate poor clinical relevance (6).

This study aimed to describe the prevalence of abnormal endoscopic and histological findings in routine preoperative upper digestive endoscopy in obese patients before bariatric procedures and evaluate its clinical impact.

Material and Method

All adult obese patients (BMI > 30 kg/m²) who undergone upper digestive endoscopy as part of preoperative work-up before bariatric surgery at Centro Hospitalar Universitário de São João (Porto, Portugal) between January 2019 and December 2021 were eligible for this retrospective study. Patients were excluded if they had altered surgical anatomy from previous surgery, if gastric biopsies were not performed (e.g., non-sedated uncooperative patients) or if they were planning revisional surgery after previous bariatric procedures.

We retrospectively reviewed the medical records of all patients in order to retrieve significant information regarding patients' characteristics, comorbidities, endoscopic, and histological findings. Anthropometric parameters including height, weight, and BMI were collected from the records of the last medical evaluation preceding endoscopy. All endoscopy reports were carefully reviewed to obtain information about intraoperative findings, number and topography of biopsies, and other relevant events. Pathology reports were also checked to search for *H. pylori* infection and histological abnormalities such as intestinal metaplasia or dysplasia. Additionally, whenever performed, we also reviewed intra-operative notes to understand the type of surgical procedure.

Statistical Analysis

Statistical analysis was performed using the SPSS 27.0 software package (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages and

compared using Chi-square or Fisher's exact test. Continuous variables were expressed as mean and standard deviation for variables with normal distribution or median and interquartile range for variables with skewed distribution and compared using Students' t-test or a nonparametric test. A two-tailed $p < 0.05$ was considered statistically significant.

The present study complies with current regulations on bioethical research and was appropriately evaluated and approved by the Ethics Committee of Centro Hospitalar Universitário de São João in Porto, Portugal. The procedures used in this study adhere to the tenets of the Declaration of Helsinki. This article does not contain personal information that could identify the study patients.

Results

A total of 612 patients were included (*Table 1*), 485 (79.2%) female and 127 (20.8%) male, with a mean age of 43.9 ± 11.0 years. Median BMI was 41.8 (39.0-45.8) kg/m². Most patients (71.9%) presented at least one obesity-related co-morbidity, most commonly arterial hypertension (44.4%), obstructive sleep apnea (31.5%), dyslipidemia (26.6%), and type 2 diabetes mellitus (20.1%). Patients with co-morbidities were significantly older than those without co-morbidities (46.1 vs 38.3 years, $p < 0.001$). There was no significant association between any co-morbidity and BMI. Patients were non-sedated in 338 (55.2%) procedures,

Table 1. Patients' characteristics

Number of patients	612
Age, mean \pm standard deviation, years	43.9 \pm 11.0
Gender	
Male	127 (20.8)
Female	485 (79.2)
Body mass index, median (IQR), kg/m ²	41.8 (39.0-45.8)
Obesity-related comorbidities	
Hypertension	272 (44.4)
Obstructive sleep apnea	193 (31.5)
Dyslipidemia	163 (26.6)
Type 2 diabetes mellitus	123 (20.1)
Asthma	25 (4.1)
Chronic obstructive pulmonary disease	18 (3.0)
Cerebrovascular disease	12 (2.0)
Coronary heart disease	4 (0.7)

Table 2. Prevalence of abnormal endoscopic findings

Abnormal endoscopic findings		n (%)
Esophagus	Reflux esophagitis	84 (13.7)
	Los Angeles A/B/C/D	62/21/1/0
	Barrett's esophagus	4 (0.7)
	Squamous papiloma	4 (0.7)
	Schatzki ring	3 (0.5)
	Candidiasis	3 (0.5)
Stomach	Erythematous gastropathy	362 (59.2)
	Gastric papules	84 (13.7)
	Erosive gastritis	65 (10.6)
	Hiatal hernia	49 (8.0)
	Polyps	33 (5.4)
	Atrophy	14 (2.3)
	Ulcers	13 (2.1)
	Angiectasia	5 (0.8)
	Subepithelial lesion	5 (0.8)
	Malignancy	1 (0.2)
Duodenum	Erosive duodenitis	25 (4.1)
	Ulcers	4 (0.7)
	Polyps	4 (0.7)

whereas the remaining 274 (44.8%) were performed under deep sedation with propofol in the presence of an anesthesiologist.

Preoperative endoscopy revealed abnormal upper gastrointestinal findings in 474 (77.5%) patients (Table 2). The stomach was the most commonly affected segment, with abnormal endoscopic findings reported in 446 (72.9%) patients. These most commonly included patterns suggestive of gastritis such as erythema (59.2%), papules (13.7%) or erosions (10.6%). The presence of a hiatal hernia was detected in 49 (8.0%) patients. Gastric polyps were found in 33 (5.4%) patients, histologically classified as hyperplastic in 17, fundic gland polyps in 13 and inflammatory fibroid polyps in 3. They were located in body in 15 patients, fundus in 10 and antrum in 8, presented with variable diameter ranging from 2-12 mm (median: 5 mm) and were completely resected with biopsy forceps or snare polypectomy in all cases. Peptic ulcer disease was detected in 13 (2.1%) patients. One case of gastric malignancy (signet-ring cell adenocarcinoma) presenting as a discrete ulcer in incisura was also detected.

Reflux esophagitis was identified in 84 (13.7%) patients: grade A in 62 (73.8%), grade B in 21 (25.0%) and grade C in 1 (1.2%), according to the Los Angeles classification. Importantly, Barrett's esophagus was detected

in 4 (0.7%) patients. These were all short segments (< 3 cm) and dysplasia was not detected in any case. Other esophageal findings included squamous papilloma (0.7%), Schatzki ring (0.5%), and candidiasis (0.5%). Duodenal abnormalities were less commonly reported in a total of 40 (6.5%) patients, most commonly erosive duodenitis (4.1%), followed by ulcers (0.7%) and polyps (0.7%). There was no significant association between preoperative BMI and any endoscopic finding. No complications were reported during or after endoscopy in any patient.

Gastric biopsies were performed from antrum and body in 509 (83.2%) patients and only from antrum in 103 (16.8%). The presence of *H. pylori* gastritis was detected in 368 (60.1%) and intestinal metaplasia in 76 (12.4%), limited to antrum in 80.3%, both antrum and body in 13.2% and limited to body in 6.6%. No cases of dysplasia were found. Patients without endoscopic abnormalities did not demonstrate higher risk of *H. pylori* infection than patients with endoscopic abnormal findings in general. However, there was significant association between certain endoscopic findings and *H. pylori* infection: gastric papules (OR 1.91, p=0.012) and erosive duodenitis (OR 3.63, p=0.013) were associated with increased risk, whereas gastric atrophy was associated with a decreased risk (OR 0.26, p=0.015). No significant association was found

Table 3. Clinical and surgical impact of abnormal endoscopic findings

	N (%)
Preoperative medical therapy	378 (61.8)
Eradication of <i>H. pylori</i>	313 (51.1)
PPI treatment of acid-related disorders	152 (24.8)
Anti-fungal treatment for candidiasis	3 (0.5)
Endoscopic treatment	47 (7.7)
Gastric polyps resected by polypectomy	33 (6.0)
Gastric angiectasias treated with APC	5 (0.8)
Esophageal Schatzki ring treated with balloon dilation	5 (0.8)
Influence on surgical strategy*	27 (7.8)
Intraoperative correction of hiatal hernia	19 (5.4)
GERD-related findings pushing towards gastric bypass	18 (5.1)
Contraindication to bariatric surgery	1 (0.2)

(PPI – proton pump inhibitor, APC – argon plasma coagulation, GERD – gastroesophageal reflux disease).

* Relative frequencies are measured considering only patients who performed bariatric surgery during follow-up

between *H. pylori* infection and age ($p=0.114$), BMI ($p=0.645$) or number of biopsies ($p=0.723$); Mann-Whitney test was used since none of these continuous variables followed a normal distribution.

Overall, abnormal endoscopic findings in preoperative upper digestive endoscopy influenced perioperative management of 403 (65.8%) patients (Table 3). These findings implicated preoperative medical therapy in 378 (61.8%) patients, including *H. pylori* eradication (51.1%), treatment of acid-related diseases (reflux esophagitis, peptic ulcers, erosive duodenitis) with proton pump inhibitors (24.8%) or antifungal treatment for candidiasis (0.5%) and often resulted in need for reevaluation and postponement of surgical procedure. Lesions amenable to endoscopic treatment were identified in 47 (7.7%) patients, including gastric/duodenal polyps (6.0%), gastric angiectasias (0.8%) or esophageal rings (0.8%). Bariatric surgery was performed in 352 (57.6%) patients so far, including gastric bypass in 245 (69.6%) and gastric sleeve in 107 (30.4%). In 27 (7.8%) of these patients, endoscopic findings directly influenced surgical strategy due to intraoperative correction of hiatal hernia (5.4%) and/or change of surgical strategy towards gastric bypass due to reflux esophagitis or Barrett's esophagus (5.1%). Bariatric procedure was contraindicated in 1 (0.2%) patient due to gastric malignancy.

Discussion

There is ongoing debate over the necessity of preoperative upper digestive endoscopy in all obese patients undergoing evaluation for bariatric surgery. Some studies confirm the high rate of diagnoses found in preoperative endoscopy, but argue that the majority of these findings are of low clinical relevance and do not change clinical management (7-9). In contrast, multiple large studies report that abnormal endoscopic findings resulted in changes of medical or surgical management in 10-64% of patients (10-14). Our study represents a large review assessing preoperative upper endoscopy findings in obese patients

and highlights a high prevalence of upper gastrointestinal pathology with abnormal endoscopic findings that carry significant impact in surgical management of bariatric patients.

There is conflicting evidence regarding symptoms as reliable predictors of abnormal endoscopic findings. Some studies report an association between symptoms and endoscopic findings (15-17), supporting a more selective screening strategy towards symptomatic patients. However, other studies addressing this specific question did not find such association (18-20), which suggests that the presence of symptoms is not a reliable criterion for patient selection. Even though obesity is a well-known risk factor for upper gastro-intestinal pathology such as reflux esophagitis, Barrett's esophagus, esophageal adeno-carcinoma, hiatal hernia, *H. pylori* gastritis or peptic ulcer disease (21-24), obesity severity also does not appear to be associated with higher prevalence of abnormal endoscopic findings, as we found no correlation between BMI and any specific diagnosis, similar to other studies (25). Therefore, until further evidence is provided, we believe it is not prudent to deny preoperative endoscopy based in BMI or absence of symptoms.

Gastritis was the most common finding in our population, consistent with other studies (11,25). Although usually considered clinically irrelevant, a statistically significant association between gastritis and postoperative anastomotic ulceration was noted (8), which suggests that preoperative knowledge and aggressive medical treatment prior to surgery may improve outcomes. The diagnostic findings of esophagitis, gastric erosions and duodenitis which we identified in 13.7%, 10.6%, and 4.1% of our patients, respectively, are generally considered more significant and are typically medically treated, sometimes requiring a surgical delay to allow for healing and repeat evaluation. These findings may also affect procedure selection by making sleeve a less attractive option. Peptic ulcer disease, which was detected in 2.8% of our patients, has also been associated with increased rates of post-

operative complications (26).

We found a hiatal hernia in 8% of cases and this finding often influenced surgical strategy adding the need for intraoperative correction of the hernia. Preoperative knowledge of a hiatal hernia allows for operative planning for repair and may also affect procedure choice. Most studies report a high prevalence in these patients ranging from 9.4 to 40.0% (16, 27, 28), therefore it appears to be underdiagnosed in our cohort. It is possible that the high proportion of procedures performed without sedation may have contributed as it may be difficult to properly evaluate the gastroesophageal junction in non-sedated, uncooperative patients. Some centers perform contrast radiographs to identify for hiatal hernias, however, this approach would miss a substantial number of important mucosal findings. Performing upper gastrointestinal contrast study together with endoscopy could also be interesting, however, there is a study where this approach only detected hiatal hernia in 11.1% during preoperative work-up, whereas hiatal hernia was detected intra-operatively in 14.5% in whom it had been missed preoperatively (29). Therefore, there is no current evidence that this strategy significantly increases preoperative detection rate, whereas it is limited by cost and radiation exposure.

Barrett's esophagus was noted in 0.7% of our patients, in line with other studies that reported a prevalence between 0.6-3.7% (10,11,30,31). Barrett's esophagus is an important consideration in the management of bariatric surgical patients. Studies suggest that sleeve gastrectomy predisposes patients to gastroesophageal reflux and Barrett's esophagus is viewed by many surgeons as a contraindication. Conversely, Roux-en-Y gastric bypass is associated with decreased reflux and potential improvement or resolution (32). Therefore, it is important to recognize Barrett's esophagus in the bariatric surgical population as preoperative endoscopy may be an opportune time to screen an already at-risk population and its detection can suggest a change of surgical strategy towards gastric bypass. Besides, the occasional detection of

esophageal adenocarcinoma has important implications for surgical management (33,34).

The finding of a single case of gastric malignancy was also relevant considering its obvious implications for definition of surgical strategy and may represent a contraindication to bariatric procedures depending on stage, as occurred in our study. The occasional finding of upper gastrointestinal malignancy in asymptomatic patients during preoperative work-up before bariatric surgery has been reported in several other studies (10,25,33, 34). In fact, current evidence suggests that obesity is a significant risk factor for both esophageal (35) and gastric (36) adenocarcinoma, which places bariatric patients at greater risk for these diseases. Therefore, the occasional incidental detection of malignancy is a strong argument in favor of routine endoscopic screening to all patients prior to bariatric surgery.

H. pylori infection is known to increase the risk of postoperative complications including marginal ulceration and perforation (37) and routine preoperative testing and treatment of positive results is recommended (38). A significant prevalence of *H. pylori* gastritis (60.1%) was detected in our study population and, importantly, it was not significantly lower in patients with a normal endoscopy compared to those with abnormal findings, although specific findings appeared to predict increased (erosive duodenitis, gastric papules) or decreased (atrophic gastritis) risk. There is conflicting evidence regarding reliability of endoscopic findings to predict *H. pylori*, with some authors reporting a significant positive association between *H. pylori* infection and abnormal endoscopic findings (18,26,39) whereas others did not find such an association (17).

It is important to note that gastric or duodenal ulcers or polyps may be an important consideration regarding selection of surgery type, since gastric bypass limits endoscopic access to the remnant. In our cohort, those findings were not regarded as contraindications to gastric bypass when it was clinically indicated, considering that medical or endoscopic treatment were provided and successful

resolution was confirmed previous to the surgical procedure in all cases. Besides, testing and eradication of *H. pylori* was also performed in every patient, which practically eliminates risk of recurrence. However, if successful treatment and *H. pylori* eradication are not possible before surgery, the presence of gastroduodenal diseases is an important consideration before performing gastric bypass surgery.

The main limitation of our study is its retrospective design which prevents an accurate determination of the percentage of cases where abnormal findings resulted in changes in surgical management. This is further complicated by the surge of COVID-19 pandemic in the midst of our study period that resulted in loss of follow-up of many patients and delays in endoscopic and surgical activity over several months, explaining why only 57.6% underwent surgery so far. The consequence is that, although we report a significant proportion of cases where preoperative endoscopic findings influenced surgical management, this impact is still probably underestimated. Nevertheless, we performed a large study that highlights a high prevalence of clinically significant upper gastrointestinal pathology in patients with obesity and reinforces the importance of implementing endoscopy in preoperative work-up protocols in centers where bariatric surgery is implemented. Large prospective controlled studies are needed to determine more accurately predictive factors of endoscopic abnormalities that could lead to more restrictive patient selection protocols for endoscopic screening.

Conclusions

In conclusion, this study confirms that obesity carries a profound health burden related to upper gastrointestinal pathology (most commonly, *H. pylori* gastritis, peptic ulcer disease or GERD-related complications like reflux esophagitis or Barrett's esophagus) and that routine preoperative upper digestive endoscopy is essential in planning bariatric surgery. We documented a high prevalence of

upper gastrointestinal pathological findings in obese patients that influence perioperative management and surgical strategy. Therefore, considering the very low complication rates associated with the endoscopic procedure, it should be routinely performed in all obese patients prior to bariatric surgery.

Authors' Contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Emanuel Dias, Margarida Marques and Marco Silva. The first draft of the manuscript was written by Emanuel Dias. Critical revision of the manuscript was performed by Margarida Marques, Marco Silva and Guilherme Macedo. All authors read and approved the final manuscript.

Conflicts of Interest and Source of Funding

The authors have no relevant financial, consultant or institutional conflicts of interest to declare.

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Ethical Statement

This study was approved by the Ethics Committee of Centro Hospitalar Universitário de São João.

References

1. Caballero B. Humans against Obesity: Who Will Win? *Adv Nutr.* 2019; 10(suppl_1):S4-s9.
2. Milano W, De Biasio V, Di Munzio W, Foggia G, Capasso A. Obesity: The New Global Epidemic Pharmacological Treatment, Opportunities and Limits for Personalized Therapy. *Endocr Metab Immune Disord Drug Targets.* 2020;20(8):1232-1243.
3. Li Q, Blume SW, Huang JC, Hammer M, Ganz ML. Prevalence and health-care costs of obesity-related comorbidities: evidence from an electronic medical records system in the United States. *J Med Econ.* 2015;18(12): 1020-8.
4. Arterburn DE, Telem DA, Kushner RF, Anita P Courcoulas. Benefits and Risks of Bariatric Surgery in Adults: A Review. *JAMA.* 2020;324(9):879-887.
5. Di Lorenzo N, Antoniou SA, Batterham RL, Busetto L, Godoroja D, Iossa A, et al. Clinical practice guidelines of the European Association for Endoscopic Surgery (EAES) on bariatric surgery: update 2020 endorsed by IFSO-EC, EASO and ESPCOP. *Surg Endosc.* 2020;34(6):2332-2358.
6. Peromaa-Haavisto P, Victorzon M. Is routine preoperative upper GI endoscopy needed prior to gastric bypass? *Obes Surg.* 2013;23(6):736-9.

7. Schigt A, Coblijn U, Lagarde S, Kuiken S, Scholten P, van Wagenveld B. Is esophagogastroduodenoscopy before Roux-en-Y gastric bypass or sleeve gastrectomy mandatory? *Surg Obes Relat Dis.* 2014;10(3):411-7; quiz 565-6.
8. Loewen M, Giovanni J, Barba C. Screening endoscopy before bariatric surgery: a series of 448 patients. *Surg Obes Relat Dis.* 2008;4(6):709-12.
9. Korenkov M, Sauerland S, Shah S, Junginger T. Is routine preoperative upper endoscopy in gastric banding patients really necessary? *Obes Surg.* 2006;16(1):45-7.
10. Zacharakis G, Almasoud A, AlZahrani J, Al-Ghamdi S, Altuwaim A, AlShehri A, et al. Upper gastrointestinal tract involvement in the management of bariatric patients in the Kingdom of Saudi Arabia. *Ann Gastroenterol.* 2021; 34(2):177-82.
11. Endo Y, Ohta M, Tada K, Saga K, Takayama H, Hirashita T, et al. Clinical significance of upper gastrointestinal endoscopy before laparoscopic bariatric procedures in Japanese patients. *Surg Today.* 2019;49(1):27-31.
12. Abou Hussein B, Khammas A, Shokr M, Majid M, Sandal M, Al Awadhi S, et al. Role of routine upper endoscopy before bariatric surgery in the Middle East population: a review of 1278 patients. *Endosc Int Open.* 2018;6(10): E1171-E1176.
13. Salama A, Saafan T, El Ansari W, Karam M, Bashah M. Is Routine Preoperative Esophagogastroduodenoscopy Screening Necessary Prior to Laparoscopic Sleeve Gastrectomy? Review of 1555 Cases and Comparison with Current Literature. *Obes Surg.* 2018;28(1):52-60.
14. Schneider R, Lazaridis I, Kraljević M, Beglinger C, Wölnerhanssen B, Peterli R. The impact of preoperative investigations on the management of bariatric patients; results of a cohort of more than 1200 cases. *Surg Obes Relat Dis.* 2018;14(5):693-699.
15. Abd Ellatif ME, Alfalah H, Asker WA, El Nakeeb AE, Magdy A, Thabet W, et al. Place of upper endoscopy before and after bariatric surgery: A multi-center experience with 3219 patients. *World J Gastrointest Endosc.* 2016; 8(10):409-17.
16. Yormaz S, Yilmaz K, Alptekin H, Ece I, Acar F, Colak B, et al. Does digestive symptoms require esophago gastroscopy prior to bariatric procedure? Assessment of 6 years' experience. *Ann Ital Chir.* 2018;89:36-44.
17. Lee J, Wong SK, Liu SY, Kwok-Wai Ng E. Is Preoperative Upper Gastrointestinal Endoscopy in Obese Patients Undergoing Bariatric Surgery Mandatory? An Asian Perspective. *Obes Surg.* 2017;27(1):44-50.
18. Azagury D, Dumonceau JM, Morel P, Chassot G, Huber O. Preoperative work-up in asymptomatic patients undergoing Roux-en-Y gastric bypass: is endoscopy mandatory? *Obes Surg.* 2006;16(10):1304-11.
19. García-Gómez-Heras S, García A, Zubiaga L, Artuñedo P, Ferrigni C, Duran M, et al. Prevalence of Endoscopic Findings Before Bariatric Surgery and Their Influence on the Selection of the Surgical Technique. *Obes Surg.* 2020;30(11):4375-4380.
20. Carabotti M, Avallone M, Cereatti F, Paganini A, Greco F, Scirocco A, et al. Usefulness of Upper Gastrointestinal Symptoms as a Driver to Prescribe Gastroscopy in Obese Patients Candidate to Bariatric Surgery. A Prospective Study. *Obes Surg.* 2016;26(5):1075-80.
21. Ohashi S, Maruno T, Fukuyama K, Kikuchi O, Sunami T, Kondo Y, et al. Visceral fat obesity is the key risk factor for the development of reflux erosive esophagitis in 40-69-years subjects. *Esophagus.* 2021;18(4): 889-899.
22. Garrow D, Delegge MH. Risk factors for gastrointestinal ulcer disease in the US population. *Dig Dis Sci.* 2010;55(1):66-72.
23. Maret-Ouda J, Markar SR, Lagergren J. Gastroesophageal Reflux Disease: A Review. *Jama.* 2020;324(24):2536-47.
24. Sakaguchi M, Oka H, Hashimoto T, Asakuma Y, Takao M, Gon G, et al. Obesity as a risk factor for GERD in Japan. *J Gastroenterol.* 2008;43(1):57-62.
25. Makiewicz K, Berbiglia L, Douglas D, Bohon A, Zografakis J, Dan A. Prevalence of Upper Gastrointestinal Pathology in Patients with Obesity on Preoperative Endoscopy. *JSLs.* 2020;24(2):e2020.00021.
26. Fernandes SR, Meireles LC, Carrilho-Ribeiro L, Velosa J. The Role of Routine Upper Gastrointestinal Endoscopy Before Bariatric Surgery. *Obes Surg.* 2016;26(9):2105-2110.
27. D'Hondt M, Steverlynck M, Pottel H, Elewaut A, George C, Vansteenkiste F, et al. Value of preoperative esophagogastroduodenoscopy in morbidly obese patients undergoing laparoscopic Roux-en-Y gastric bypass. *Acta Chir Belg.* 2013;113(4):249-53.
28. Sharaf RN, Weinshel EH, Bini EJ, Rosenberg J, Sherman A, Ren CJ. Endoscopy plays an important preoperative role in bariatric surgery. *Obes Surg.* 2004;14(10):1367-72.
29. Soricelli E, Iossi A, Casella G, Abbatini F, Cali B, Basso N. Sleeve gastrectomy and crural repair in obese patients with gastroesophageal reflux disease and/or hiatal hernia. *Surg Obes Relat Dis.* 2013;9(3):356-61.
30. Zeni TM, Frantzides CT, Mahr C, Woody Denham E, Meiselman M, Goldberg MJ, et al. Value of preoperative upper endoscopy in patients undergoing laparoscopic gastric bypass. *Obes Surg.* 2006;16(2):142-6.
31. Mong C, Van Dam J, Morton J, Gerson L, Curet M, Banerjee S. Preoperative endoscopic screening for laparoscopic Roux-en-Y gastric bypass has a low yield for anatomic findings. *Obes Surg.* 2008;18(9):1067-73.
32. Ooi GJ, Browning A, Hii MW, Read M. Perioperative screening, management, and surveillance of Barrett's esophagus in bariatric surgical patients. *Ann N Y Acad Sci.* 2020;1481(1):224-235.
33. Humphreys LM, Meredith H, Morgan J, Norton S. Detection of asymptomatic adenocarcinoma at endoscopy prior to gastric banding justifies routine endoscopy. *Obes Surg.* 2012;22(4):594-6.
34. Moulla Y, Lyros O, Mehdorn M, Lange U, Hamade H, Thieme R, et al. Preoperative Upper-GI Endoscopy Prior to Bariatric Surgery: Essential or Optional? *Obes Surg.* 2020;30(6):2076-2084.
35. Uhlenhopp DJ, Then EO, Sunkara T, Gaduputi V. Epidemiology of esophageal cancer: update in global trends, etiology and risk factors. *Clin J Gastroenterol.* 2020;13(6):1010-1021.
36. Crew KD, Neugut AI. Epidemiology of gastric cancer. *World J Gastroenterol.* 2006;12(3):354-62.
37. Mocanu V, Dang JT, Switzer N, Skubleny D, Shi X, de Gara C, et al. The Effect of Helicobacter pylori on Postoperative Outcomes in Patients Undergoing Bariatric Surgery: a Systematic Review and Meta-analysis. *Obes Surg.* 2018;28(2):567-573. doi: 10.1007/s11695-017-3024-8.
38. Mechanick JL, Youdim A, Jones DB, Garvey WT, Hurley DL, McMahon MM, et al. Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient--2013 update: cosponsored by American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic & Bariatric Surgery. *Obesity (Silver Spring).* 2013;21 Suppl 1(0 1):S1-27.
39. Muñoz R, Ibáñez L, Salinas J, Escalona A, Pérez G, Pimentel F, et al. Importance of routine preoperative upper GI endoscopy: why all patients should be evaluated? *Obes Surg.* 2009;19(4):427-31.