

Esophageal functional disorders in the pre-operative evaluation of bariatric surgery

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ABSTRACT – Background – Obesity is an independent risk factor for esophageal symptoms, gastroesophageal reflux disease (GERD), and motor abnormalities. When contemplating bariatric surgery, patients with obesity type III undergo esophagogastroduodenoscopy (EGD) and also esophageal manometry (EMN), and prolonged pHmetry (PHM) as part of their pre-operative evaluation. **Objective** – Description of endoscopy, manometry and pHmetry findings in patients with obesity type III preparing for bariatric surgery, and correlation of these findings with the presence of typical GERD symptoms. **Methods** – Retrospective study in which clinical symptoms of GERD were assessed, focusing on the presence of heartburn and regurgitation. All patients underwent EMN, PHM and most of them EGD. **Results** – 114 patients (93 females–81%), average age 36 years old, average BMI of 45.3, were studied. Typical GERD symptoms were referred by 43 (38%) patients while 71 (62%) were asymptomatic. Eighty two patients (72% of total) underwent EGD and 36 (42%) evidenced esophageal abnormalities. Among the abnormal findings, hiatal hernia was seen in 36%, erosive esophagitis (EE) in 36%, and HH+EE in 28%. An abnormal EMN was recorded in 51/114 patients (45%). The main abnormality was a hypotensive lower esophageal sphincter (LES) in 32%, followed by ineffective esophageal motility in 25%, nutcracker esophagus in 19%, IEM + hypotensive LES in 10%, intra-thoracic LES (6%), hypertensive LES (4%), aperistalsis (2%) and achalasia (2%). Among the 43 symptomatic patients, 23 (53%) had abnormal EMN and 31/71 asymptomatic cases (44%) also presented this finding ($P=0.30$). PHM showed abnormal reflux in 60/114 patients (53%), with a predominance of bi-positional reflux (42%), followed by supine reflux (33%) and upright reflux (25%). Abnormal PHM was found in 26/43 symptomatic cases (60%) and also among 34/71 asymptomatic cases (48%) ($P=0.19$). **Conclusion** – Manometric abnormalities were common in obesity type III patients, the most frequent being hypotensive LES, followed by IEM. Most patients were asymptomatic. There was no correlation between the finding of motor abnormalities and the presence of symptoms. More than half the patients had abnormal reflux at PHM. We found no significant correlation between abnormal reflux and the presence of symptoms.

Keywords – Bariatric surgery; obesity; esophageal functional disorders.

INTRODUCTION

Obesity and gastroesophageal reflux disease (GERD) are both very prevalent in developed countries, having evolved into a public health problem affecting 61% of the USA population⁽¹⁾. In the last data collect in 2018, the Brazilian health authority evaluated more than 73,000 people living in different areas and found that 55.7% of adults presented weight excess or obesity⁽²⁾. Although obesity is considered a disease in itself, it is also an important risk factor for many other diseases, such as diabetes mellitus, arterial hypertension and coronary artery disease. Obesity is an independent risk factor for esophageal symptoms, GERD and motor abnormalities⁽³⁾. Therefore, an effective control of obesity is an essential therapeutic aim, and bariatric surgery is the only effective treatment for obesity type III as it leads to sustained weight loss and improvement of co-morbidities. There are several approaches to the surgical treatment of patients with obesity type III, each one with its particular advantages and disadvantages⁽¹⁾. When determining the appropriate surgical strategy, clinicians should consider patient history, preoperative symptoms, pre-existing esophageal motility and esophageal acid exposure. It is

still unclear whether candidates to bariatric surgery should perform pre-operative reflux testing or not, but they frequently undergo esophagogastroduodenoscopy (EGD), pHmetry (PHM) and esophageal manometry (EMN) as part of their pre-operative evaluation. This paper reports findings in obesity type III patients, and correlates them with the presence of typical symptoms of GERD.

METHODS

This is a retrospective pre-operative study of obesity type III patients (BMI= \geq 40) heading to for bariatric surgery. Our study focused on the presence of typical symptoms of GERD, such as heartburn and regurgitation. Most patients underwent EGD and all had EMN and PHM.

Esophagogastroduodenoscopy

We accessed the presence of hiatal hernia, defined as an esophago-gastric junction situated 2 cm or more above the diaphragmatic impression on the esophagus. Esophagitis was defined and described according to the Los Angeles classification criteria⁽⁴⁾.

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Esophageal manometry

In our manometric studies, we employed a polyvinyl catheter with eight lumens, 4.5 mm external diameter and four proximal openings 5 cm apart and four distal openings radially oriented at the same level. Each of the openings of this setting was connected to external pressure transducers and was perfused with distilled water originating from a system of capillary infusion (Alacer, Brazil). Intraluminal pressures were recorded in a polygraph and the digital information transferred to a computer. The lower esophageal sphincter (LES) was examined with the distal openings with the slow-pull technique, and five water swallows to evaluate the LES relaxation. The esophageal body was studied by placing the proximal openings of the catheter at 3, 8, 13 and 18 cm above the upper limit of the LES. Ten swallows of water at room temperature were recorded at 20 seconds intervals. At the end of the test, the readings were interpreted by means of a specific software. The manometric diagnosis followed international criteria⁽⁵⁾, adapted to normal values obtained at previous studies in asymptomatic volunteers⁽⁶⁾.

Prolonged esophageal pHmetry

The monitoring of intra-esophageal pH was performed by a portable digital system (Alacer, Brasil) attached to an antimony catheter positioned at 5 cm above the LES upper limit, as previously described for EMN, and linked to an external reference electrode. This exam was performed with the patient leading a normal life and a liberal diet, with restriction of citric fruits and juices and carbonated beverages only. Proton-pump inhibitors (PPIs) were discontinued 7 days, H-2 receptor antagonist 72 hours and prokinetic drugs 24 hours before the test. We considered PHM as abnormal when the percentage of the total PHM test time with a recording below pH four was higher than 4.5%, higher than 7.0% in the orthostatic position and 2.5% in the supine position⁽⁷⁾.

Statistical analysis

We used IBM SPSS Student test, and considered $P < 0.05$ as the level of significance.

RESULTS

Our study included 114 patients, 93 (81%) females, ages ranging between 19-64 years old (average age = 36) and an average BMI of 45.3 (40–52). Typical symptoms of GERD (heartburn and/or regurgitation) were referred by 43 (38%) patients, the remaining 62% being asymptomatic.

Esophagogastroduodenoscopy

This test was performed in 82 patients, and esophageal abnormalities were found in 36 (42%). Among the abnormal cases, 13 (36%) had hiatal hernia (HH), 13 (36%) erosive esophagitis (EE) (10 with L.A. grade A and 3 with grade B) and 10 (28%) HH+EE (4 L.A. grade A and 6 grade B).

Esophageal manometry

EMN was abnormal in 51/114 (45%) patients. Among the abnormal readings, the predominant finding was hypotensive LES (<10 mmHg) in 32%, followed by ineffective esophageal motility (25%), nutcracker esophagus (19%), hypotensive LES+ ineffective esophageal motility (IEM) (10%), intrathoracic LES (6%), hypertensive LES (4%), aperistalsis (2%) and achalasia (2%) (TABLE 1).

TABLE 1. Abnormal esophageal manometry (n=51/114 cases – 45%).

Abnormality	Number of patients	Percentage
Hypotensive LES	16	32%
IEM	13	25%
NE	10	19%
Hypotensive LES+IEM	5	10%
Intrathoracic LES	3	6%
Hypertensive LES	2	4%
Aperistalsis	1	2%
Achalasia	1	2%

LES: lower esophageal sphincter, IEM: ineffective esophageal motility, NE: nutcracker esophagus.

Esophageal manometry vs symptoms

Among the 43 symptomatic patients, 23 (53%) presented with an abnormal EMN, while 31/71 (44%) asymptomatic cases also showed abnormal findings ($P=0.30$) (TABLE 2).

TABLE 2. Esophageal manometry vs symptoms.

Symptoms	Normal EMN	Abnormal EMN
Present = 43	20 (47%)	23 (53%)
Absent = 71	40 (56%)	31 (44%)

$P=0.30$. EMN: esophageal manometry.

Prolonged pHmetry

PHM revealed abnormal reflux patterns in 60/114 patients (53%). The bi-positional reflux pattern predominated, being registered in 25 (42%) of cases followed by supine reflux pattern in 20 (33%) and upright reflux pattern in 15 (25%) (TABLE 3). Twenty-six (60%) of the symptomatic patients showed an abnormal PHM, while 34/71 (48%) of asymptomatic cases also presented such findings. There was no significant correlation between the presence of reflux symptoms and the finding of an abnormal reflux pattern ($P=0.19$) (TABLE 4).

TABLE 3. Abnormal prolonged pHmetry (60/114 cases – 53%).

Reflux pattern	Number of patients	Percentage
Bi-positional	25	42 %
Supine	20	33 %
Upright	15	25 %

TABLE 4. Prolonged pHmetry vs symptoms.

Symptoms	Normal PHM	Abnormal PHM
Present (n=43)	17 (40%)	26 (60%)
Absent (n=71)	37 (52%)	34 (48%)

$P=0.19$. PHM: prolonged pHmetry.

DISCUSSION

Obesity occurs in about 10% of the world population and is an important factor in the genesis of GERD symptoms, hiatal hernia, esophagitis, and Barrett's esophagus^(1,3). Obesity type III patients present with co-morbidities such as arterial hypertension, diabetes mellitus and coronary artery disease, as well as a significant worsening of their quality of life. Bariatric surgery is an important contribution to this group of patients that fail to manage their excessive weight by more traditional methods. Candidates for bariatric surgery undergo EGD, and, in most centers, EMN and PHM.

Obesity type III patients often present with symptoms of GERD, such as heartburn and regurgitation in up to 60% of cases⁽¹⁾. In our study, they were present in 38%, a finding parallel to that in another study involving 154 candidates to bariatric surgery, where 30.51% presented with heartburn⁽⁸⁾.

At EGD, it is known that obesity predisposes to hiatal hernia due to increased intra-abdominal pressure pushing the LES into the thorax. It also weakens the normal mechanisms that prevent gastro-esophageal reflux⁽⁹⁾. A large study involving 1,213 patients and correlating the presence of hiatal hernia and erosive esophagitis with BMI demonstrated that obese subjects had 4.2 times more chance to present with hiatal hernia than lean subjects. It also showed that the prevalence of the latter in obese patients was 40% as compared with 12.5% in the general population⁽⁹⁾. Associated esophagitis was found in 38.9% of HH patients and HH was an independent predictor of esophagitis. The prevalence of esophagitis increased along with the increase of BMI. In our study erosive esophagitis was found in 23 of the 82 (28%) patients that underwent EGD. They all classified as A or B of the LA classification, in agreement with a national study which found esophagitis in 25.2% of 154 candidates to bariatric surgery⁽⁸⁾.

According to a recent paper on the Lyon Consensus, LA grade A can be observed in asymptomatic people and the prevalence of grade B varies among observers. Therefore, the Consensus recommends pHmetry to confirm abnormal reflux in these patients⁽¹⁰⁾.

Our manometric studies were abnormal in 45% of all obese patients, hypo-contractile abnormalities being the most frequent finding. In other studies, manometric abnormalities have also been found in obese and obesity type III patients. In one of these, EMN was abnormal in 51% of 53 obesity type III patients, hypomotility being found in 85% of the abnormal tests or 43% of the whole group⁽¹¹⁾. Another study found hypotensive LES in 46% of 88 patients⁽¹²⁾.

Nutcracker esophagus (NE) was the third most frequent abnormality in our group. This hypercontractile motor disorder shows characteristically high amplitude waves in the distal esophagus⁽¹³⁾ and its main symptoms are chest pain and dysphagia^(13,14). In 30–40% of patients with NE there is associated reflux as seen by PHM, and studies show that there is no difference in clinical and manometric findings between groups with and without reflux⁽¹⁵⁾. Thus, we suggest NE patients should undergo PHM, since this disorder is managed with calcium channel-blockers, which lower the LES pressure and increase the possibility of reflux⁽¹³⁾.

Another study stresses the importance of obesity as a risk factor for GERD and a potential modulator of esophageal motility. Fornari et al. studied 332 patients categorized as GERD and non-GERD after clinical assessment, esophageal conventional manometry and pH monitoring. Non-obese and obese patients were compared regarding distal esophageal amplitude, LES pressure, manometric diagnosis and esophageal acid exposure. The

obese patients differed from non-obese in terms of esophageal motility and reflux, regardless of the presence of GERD. Obese patients showed stronger peristalsis and increased acid exposure in the esophagus⁽¹⁶⁾.

One of our patients had the manometric diagnosis of achalasia. This has already been reported in obesity type III patients⁽¹⁷⁾. The main symptoms of achalasia are dysphagia, regurgitation and weight loss⁽¹⁸⁾. Some patients present overlapping clinical features, which in some cases may suggest GERD, due to the occurrence of frequent regurgitation and heartburn, seen in at least 40%⁽¹⁹⁾. The association of untreated achalasia and obesity type III stresses the importance of this diagnosis in the pre-operative evaluation of bariatric surgery⁽²⁰⁾.

Another study using pre-operative EMN for the selection of patients to vertical gastrectomy found abnormal results in 49% of 73 patients, hypertension of the LES being the most frequent finding, followed by an increased amplitude of peristaltic waves (not defined by the authors as NE) and hypotensive LES⁽²¹⁾.

Forty-three of our 114 (38%) patients had typical reflux symptoms. Manometric abnormalities were not predictive of the presence of symptoms in obesity type III patients, although our study only focused on typical GERD symptoms. A high prevalence of asymptomatic motor abnormalities have been found on obesity type III patients⁽²²⁾. EMN performed in 111 such patients showed motor abnormalities in 61%, mostly a hypocontractile pattern, but there were also 16 cases of NE eight with diffuse spasm and one with achalasia. Most of the latter referred no dysphagia or were totally asymptomatic. These findings suggest to the authors, that some patients with obesity type III may represent instances of abnormal visceral sensitivity⁽²²⁾.

Earlier studies on prolonged pHmetry mentioned abnormal reflux in 30–42% of obesity type III patients^(23,24). The prevalence of abnormal reflux in these patients is high, even in the absence of associated esophagitis. In a group of 50 obesity type III patients evaluated for bariatric surgery, 28 (56%) had abnormal reflux a PHM⁽¹⁾. Another study found abnormal PHM in 65% of 88 patients⁽¹¹⁾.

Similarly, there was no significant difference between abnormal reflux and the presence of typical GERD symptoms (TABLE 4), suggesting that patients with abnormal reflux and obesity type III can be asymptomatic. In another study half of the asymptomatic patients presented with abnormal reflux, while in the symptomatic group the proportion of reflux rose to 80% ($P>0.42$). The authors stress the relationship between the presence of symptoms and reflux, although the absence of symptoms does not rule out an abnormal pHmetry⁽¹²⁾. Another paper suggests that patients with esophagitis and symptoms of reflux should undergo EMN and PHM in the pre-operative evaluation of bariatric surgery, especially those facing restrictive procedures. These tests would not be necessary in the absence of symptoms or esophagitis, since results were similar to those in a group of asymptomatic volunteers⁽²⁵⁾. This indicates that the literature on significance of symptoms is controversial.

Our study has some limitations. This is a retrospective study and we did not access to the data of all patients. The endoscopy had been performed by 72% of the patients up to the moment the functional tests were performed.

We are unaware if the patients underwent surgery or what procedure was carried out. Besides, we do not know if the findings of the tests influenced the decision process regarding the type of

surgery. In addition, we employed conventional manometry and the more utilized esophageal motor disorders classification of Spechler and Castell⁽⁶⁾.

Recently the indication of esophageal functional tests, manometry and ph-monitoring in pre-operative evaluation of bariatric surgery has been an emerging recommendation⁽²⁶⁾

In summary, this is a descriptive study about functional tests in a group of obesity type III patients before surgery. The data presented here were similar to those in the pertinent literature and show the lack of correlation between typical symptoms and abnormal tests.

We did not have in our objectives, to do any recommendations based in these findings. However, more studies are needed, with special emphasis on the follow-up of patients after surgery.

CONCLUSION

Manometric abnormalities were observed in patients with obesity type III, a hypotensive LES being the most frequent followed by ineffective esophageal motility. Most patients were asymptomatic.

More than half of them presented with abnormal reflux at prolonged pHmetry. There was no significant correlation between abnormal reflux and the presence of symptoms. There was no correlation between abnormal motility findings and the presence of symptoms.

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Authors' contribution

Lemme EMO: main researcher, data collection, analysis, and writing of the text. Alvariz AC: data collection, additional writing and text review. Pereira GLC: text review.

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RESUMO – Contexto – A obesidade é fator de risco independente para sintomas esofagianos, doença do refluxo gastroesofágico (DRGE) e alterações motoras. Pacientes com obesidade tipo III, candidatos à cirurgia bariátrica foram submetidos a endoscopia digestiva alta (EDA) e também realizaram esofagomanometria (EMN) e pHmetria prolongada (PHM) como parte da avaliação pré-operatória. **Objetivo** – Em um grupo de pacientes com obesidade tipo III em pré-operatório de cirurgia bariátrica, descrever os achados endoscópicos, manométricos e pHmétricos, correlacionando-os com a presença de sintomas típicos de DRGE. **Métodos** – Estudo retrospectivo, de pacientes com obesidade tipo III, candidatos a cirurgia bariátrica. A avaliação clínica focalizou a presença de sintomas típicos de DRGE (pirose/regurgitação); todos foram submetidos a EMN, PHM e a maior parte à EDA, realizada previamente. **Resultados** – Foram incluídos 114 pacientes, 93 (81%) do sexo feminino, média de idade de 36 anos e IMC médio de 45,3. Sintomas típicos de refluxo foram referidos por 43 (38%) pacientes e 71 (62%) eram assintomáticos. EDA foi realizada por 82 (72%) pacientes, havendo anormalidades esofagianas em 36 (42%). Entre os anormais, havia hérnia hiatal (HH) em 36%, esofagite erosiva (EE) em 36% e HH + EE em 28%. A EMN foi anormal em 51/114 (45%). Entre os anormais, predominou o esfíncter esofágico inferior (EEI) hipotenso em 32%, seguido por motilidade esofágica ineficaz (MEI) em 25%, esôfago em quebra-nozes (19%), EEI hipotenso + MEI (10%), EEI intra-torácico (6%), EEI hipertenso (4%), aperistalse (2%) e acalasia (2%). Dentre os 43 sintomáticos, 23 (53%) apresentavam EMN anormal, sendo que em 31 dos 71 (44%) assintomáticos a EMN também era anormal ($P=0,30$). A PHM revelou refluxo anormal em 60 (53%) pacientes. Predominou o refluxo anormal biposicional (42%) seguido do refluxo supino (33%) e refluxo ereto (25%). Dentre os 43 pacientes sintomáticos, 26 (60%) apresentavam PHM anormal, sendo que em 34 dos 71 assintomáticos a PHM também era anormal (48%) – $P=0,19$. **Conclusão** – Alterações manométricas foram comuns em obesidade tipo III, sendo as mais frequentes o EEI hipotenso, seguida de motilidade ineficaz. A maioria dos pacientes era assintomática. Mais da metade dos pacientes apresentou refluxo anormal à PHM. Não houve diferença significativa entre o achado de refluxo anormal e a presença de sintomas. Não houve relação entre o achado de alterações motoras e a presença de sintomas.

Palavras-chave – Cirurgia bariátrica; obesidade; alterações funcionais do esôfago.

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