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Review Article

Lower Esophageal Sphincter is Weaker after Sleeve Gastrectomy: Its Clinical Consequences

Italo Braghetto* and Juan Carlos Molina

Department of Surgery, University of Chile, Chile

***Corresponding author**

Italo Braghetto, Department of Surgery, Hospital Clínico "Dr Jose J. Aguirre", Faculty of Medicine, University of Chile, Santos Dumont 999, Chile, Tel: 569-813-92771; Email: ibraghet@hcuch.cl

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Abstract

Sleeve gastrectomy (SG) has been validated as an effective stand - alone bariatric procedure to treat patients with severe and morbid obesity. There are concerns about the development of De Novo gastro esophageal reflux disease after Sleeve Gastrectomy (SG) can occur after. There is no consensus regarding this effect, with several publications showing reduction in Reflux Symptoms and many other showing a significant increase in erosive esophagitis, Reflux Symptoms and esophageal exposure to acid after surgery. There are pathophysiological mechanisms involved as cause of these findings, mainly defective lower esophageal sphincter (LES). In this article we shows the current knowledge about the changes observed on the LES and its possible clinical consequences regarding to postoperative symptoms and appearance os erosive esophagitis and Barrett´ esophagus.

ABBREVIATIONS

LES: Lower Esophageal Sphincter; SG: Sleeve Gastrectomy

INTRODUCTION

Obesity is associated with an increase in the risk of Gastro esophageal Reflux Disease (GERD), Barrett esophagus, erosive esophagitis and Esophageal Carcinoma [1-5]. Sleeve gastrectomy has been validated as an effective stand-alone bariatric procedure to treat patients with severe and morbid obesity, showing a mean excess weight loss between 60 and 70% during the first year [6-8]. Despite this positive effect regarding weight reduction and improvement in comorbidities, there are concerns about the development of "de novo" gastro esophageal reflux disease after Sleeve Gastrectomy (SG). There is no consensus regarding this effect, with several publications showing reduction in Reflux Symptoms and many other showing a significant increase in erosive esophagitis, Reflux Symptoms and esophageal exposure to acid due to anatomic and patho-physiological and modifications on the esophago-gastric function [1,8-14].

It is very well known that one of the most important barriers that protect the esophagus from reflux is the Lower Esophageal Sphincter (LES). This anatomical and functional structure differs from other sphincters in the disposition of the muscular fibers. The LES is not a ring, it is composed by longitudinal, clasps and sling muscular fibers located in the distal esophagus and the cardia, determining a 3 to 4 cm long high pressure segment of the abdominal esophagus that prevents reflux of gastric content towards the esophagus [15,16]. This anatomic structure is modified when a sleeve gastrectomy is performed, dividing the sling fibers and compromising the efficiency of the LES, provoking a decrease in the resting pressure of this sphincter. [Figure 1] Wide sleeve gastrectomy probably does not produce these anatomical changes because sling fibers are not divided, but it is not an adequate sleeve.

Manometric studies and its relation with GERD

This was observed by our group in a trial published in 2010, in which we studied the manometric changes in LES after sleeve gastrectomy. Preoperative mean LES resting pressure (LESRP) was 14.2 ± 5.8 mmHg and decreased significantly after the surgery to a mean value of 10.5 ± 6.06 mmHg (P=0.01). Fifteen percent of patients presented normal LESRP (23.1 ± 3.7 mmHg) and 85% of hypotensive, with a mean resting pressure of 8.3 ± 2.6 mmHg. After surgery, the length of the high-pressure zone was also affected, with 45% of patients with shortened total length (shorter than 3,5cm) and 70% with abdominal length shorter than 1 cm [17] [Figure 2].

We also observed the presence of increased GER with scintigraphic assessment, endoscopic erosive esophagitis, and cardia dilatation [18]. More recently, in patients who have severe esophagitis after sleeve and converted to gastric bypass, we have observed incompetent LES with resting pressure as low as 4.3 mmHg and total length less than 3cm.

Burgerhart [19] obtained similar results regarding LES pressure after sleeve gastrectomy. He observed a decrease in LES resting pressure form 18.3 ± 9.2 to 11.0 ± 7.0 mmHg (p=0.02) measured by high-resolution manometry. He also observed a significant increase in esophageal exposure to acid measured by 24-h pH/impedance-metry. Concerning to the LES function after sleeve gastrectomy we recognize that up to now there are not consensus, eight studies used esophageal function tests have demonstrated paradoxical results, 3 papers shows increased

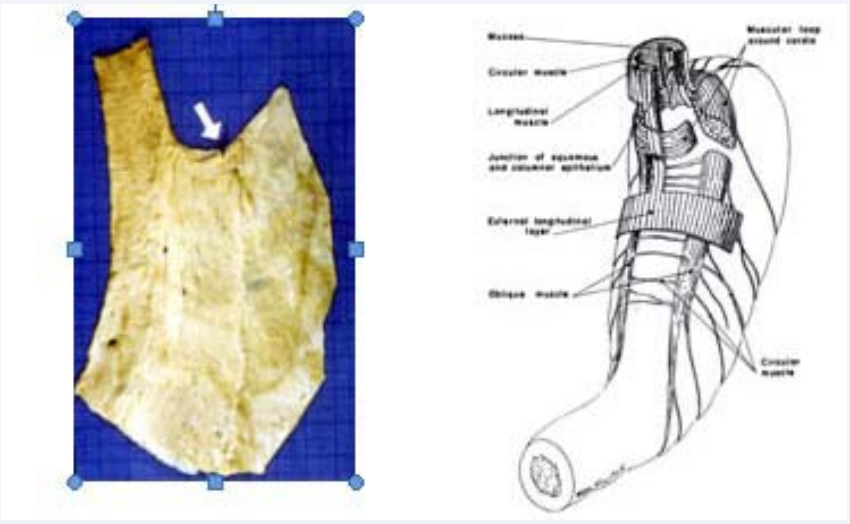
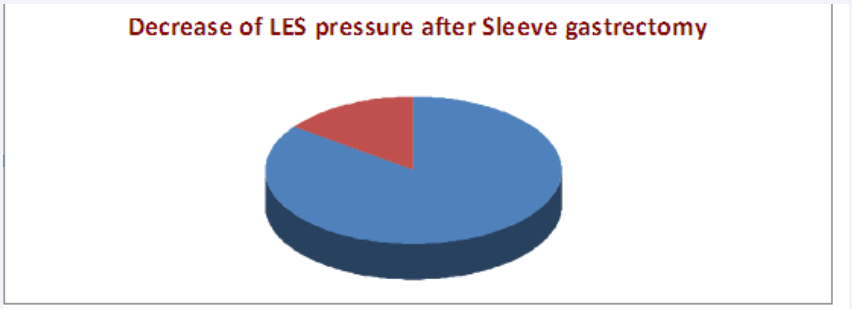


Figure 1 LES modification after division of sling fiber during sleeve gastrectomy.



Decrease	Mean	SD	Range
LES pressure	3,05	4,77	-6,5 – 12,3

Figure 2 Manometry: Early Results (6 months after surgery).

LES pressure after sleeve [14,20-22], on the contrary, the others authors demonstrated deleterious effect on LES pressure reporting LES pressure decreasing from 18.3 ± 9.2 to 11.0 ± 7.0 mmHg ($p = 0.02$). After LSG, patients have significantly higher esophageal acid exposure, which may well be due to a decrease in LES resting pressure following the procedure and pooled incidence of new-onset GERD symptoms was 20%, and new-onset esophagitis ranged from 6.3% to 63.3%. [14,19,23-25]. Del Genio et al. [14], with high resolution manometry showed an unchanged LES function, increased ineffective peristalsis, and incomplete bolus transit, but interestingly, in the same study, 24-h pH/impedance metry showed an increase of both acid exposure of the esophagus and number of non-acid reflux events in postprandial periods. The explanation for these findings could be that transient relaxations induce an increase in reflux episodes or increased intragastric pressure. ("squeeze" phenomenon). Petersen and Kleidi [21,22] reported that sleeve gastrectomy significantly increased LES resting pressure independent of weight loss and they suggest that this surgery may protect obese patients from GERD. They think that this difference is due to technical issues, explaining that the position of the stapler in relation to the angle of His is an important factor. However, in the same paper they described that gastroscopy demonstrated cardiac insufficiency, esophagitis and presence of Hiatal Hernia in most patients. It is hard to find an explanation to these findings, if those patients had an increased LES resting pressure. We have studied patients after 5 year post sleeve gastrectomy, patients without reflux presented a LES resting pressure of 18.3 ± 4.2 mmHg (Range 12.2 to 18.3) while patients with reflux symptoms presented a LES resting pressure of 9.8 ± 2.1 mmHg (Range 9.6 to 10,9 mmHg) and most of them were converted to laparoscopic Roux en Y gastric bypass, due to positive acid reflux on 24hr pH monitoring with elevated De Meester´s score (range=25-52). More recently, other papers regarding to this specific point have been published. Gorodner [23] found preoperative normotensive LES in 93% of patients. After sleeve gastrectomy, LES was normal in 71% (p = ns), but decreased LES pressure from 17.1 to 12.4 mmHg ($p \leq 0.05$) was observed, De Meester´s score increased from 12.6 to 28.4 ($p \leq 0.05$). Thirty six percent of patients had "de novo" GERD, 21% GERD worsened, and 7% remained with GERD. Similar evidences of increased gastroesophageal reflux disease after sleeve was published by Tai and others. [23-25]. Himpens [8] published GERD appearance de novo in 21.8% of patients after 1 year, but 3 years later only 3.1% of patients remained with GERD.

Intragastric pressure modification after sleeve: relation with LES pressure and reflux

Another interesting effect of sleeve gastrectomy is the distortion in the intragastric pressure. Yehoshua et al. [26], observed that basal intragastric pressure does not change after sleeve gastrectomy, but increased significantly after the occlusion of the stomach and filling with saline, implying an important decrease in gastric distensibility. This phenomenon might produce an increase in gastro esophageal pressure gradient after meals, augmenting the reflux of gastric content. In this sense, anatomical modifications after surgery, with high risk of disruption of EGJ morphology and modifications at gastric body (presence of strictures or fundus dilatation) have enormous importance for the development of pathophysiological changes on intragastric pressure and on the LES resting pressure. Mion and Tolone [27-30], demonstrated increased intragastric pressure very frequently in patients after SG (77 %) and were not associated with any upper gastrointestinal symptoms, specific esophageal manometric profile, or impedance reflux. Impedance reflux episodes were also frequently observed after SG (52 %) significantly associated with gastroesophageal reflux symptoms and ineffective esophageal motility. The sleeve volume and diameters were also significantly smaller in patients with impedance reflux episodes ($p<0.01$). This should explain why Himpens observed decrease of GERD symptoms after an initial increase described. After one year the sleeve remains narrow, but after 3 years the gastric tube gets wider and compliance is heightened, reducing the intragastric gradient pressure, and therefore the gastro esophageal reflux or decrease LESP with time [31].

Anatomic findings: Cardia dilatation and hiatal hernia associated with lower esophageal sphincter pressure

There are radiological and endoscopic evidences of enlargement of cardia diameter or presence of hiatal hernia that are associated with an incompetent LES [Figure 3, Figure 4]. Actually, high resolution manometry can provide accurate information about EGJ morphology after sleeve and demonstrate increasing separation between LES and diaphragmatic crura can cause a gradual and significant increase in reflux [28-30].

CONSEQUENCES

As consequences of the commented factors, there are clinical evidences of "de novo" appearance of GERD symptoms, esophagitis and Barrett´s esophagus after sleeve gastrectomy (range 7.8 to 21%). Eighty percent of patients submitted to SG had a mild-to-severe reflux obviously associated with incompetent LES or other pathophysiologic mechanisms [18,23-25]. Studies assessed with radionuclide scintigraphy revealed a significant rise of GERD from 6.25% to 78.1% in the postoperative period ($p<0.001$), in same time, upper gastrointestinal endoscopy showed a rise in incidence of esophagitis from 18.8% to 25% [32-34]. In agreement with these experiences we have observed very severe endoscopic esophagits (Grade C) after sleeve.

Due to this finding most patients have been converted to Roux-en-Y- Gastric bypass. Recently, an Austrian´s study published that 14.0% of patients previously submitted to sleeve gastrectomy were converted to RYGB due to intractable reflux over a period of 130 months, gastroscopies revealed de novo hiatal hernias in 45% of the patients and Barrett's metaplasia in 15%. In another

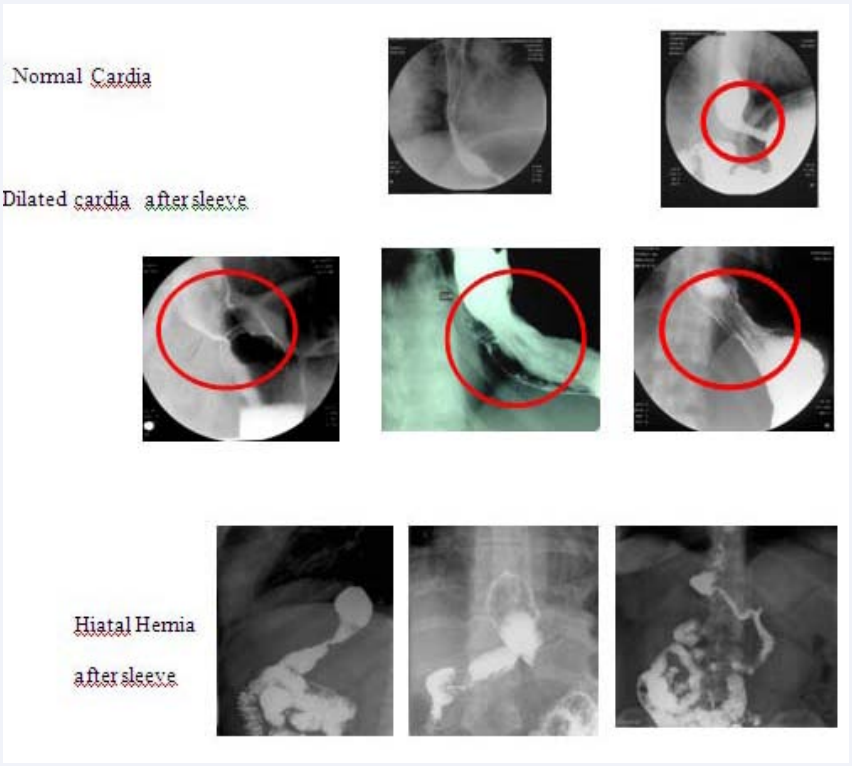


Figure 3 Anatomical evidences, Radiologic images: Dilated cardia and Hiatal Hernia.

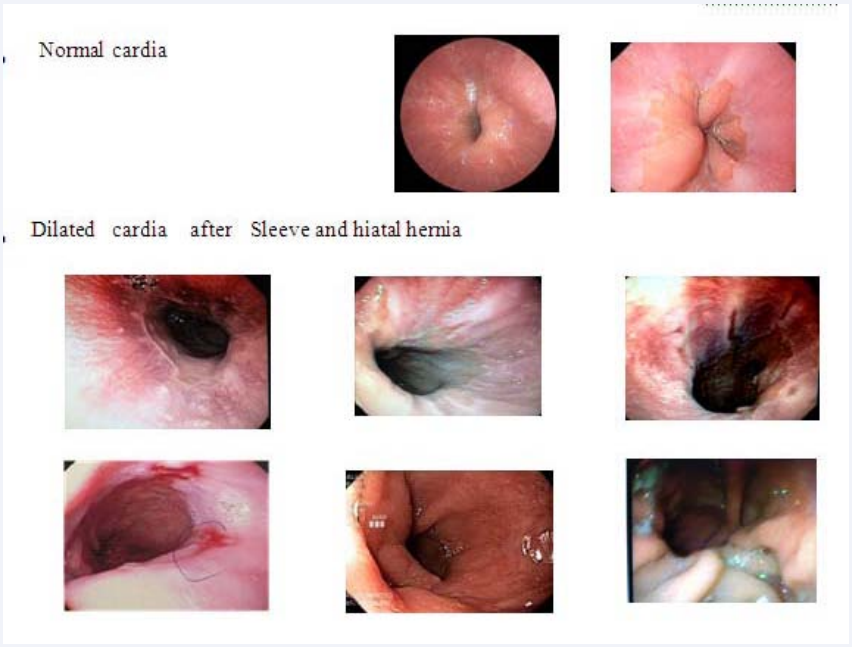


Figure 4 Anatomical evidences: Endoscopic Images.

study, Italian´s authors demonstrated a significant increase in the incidence and severity of erosive esophagitis, whereas non-dysplastic Barrett's esophagus was newly diagnosed in 19 patients (17.2%). This study shows a high incidence of Barrett's esophagus and hiatal hernias more than 10 years after SG. Their results suggest that if pre-existing large hiatal hernia, GERD, and Barrett's esophagus are present, they are relative contraindications to SG [34-37]. On the contrary, in the last years several authors have suggested to perform hiatal hernia repair and sleeve gastrectomy concomitantly [38-40].

CONCLUSIONS

In conclusion up to now, LES seems to be weaker and promotes reflux in high proportion of patients. Studies assessing the prevalence of post-operative gastro-esophageal reflux disease show sleeve gastrectomy may provoke de novo GERD symptoms or worsening of pre-existing GERD. Nadaleto summarize the mechanisms, results and outcome concerning to GERD after sleeve gastrectomy [41]. Pathophysiological mechanisms of GERD after sleeve gastrectomy include a hypotensive lower esophageal sphincter, increased gastro-esophageal pressure gradient and intra-thoracic migration of the remnant stomach. A reduction in the compliance of the gastric remnant may provoke an increase in transient lower esophageal sphincter relaxations. Obviously, we still need to learn so much about the pathophysiological effects of bariatric procedures to really understand all the clinical consequences of these operations and the evolution of patients. More data concerning to the proper technique performed, anatomical factors, physiologic changes, time of follow-up etc, are necessary to get more definitive conclusions regarding the relation between sleeve gastrectomy and GERD, but with the information available up to now, this procedure increases GERD and one of the most important factor is the impairment in the dynamics of the LES secondary to the anatomical changes determined by sleeve gastrectomy.

REFERENCES

1. Hampel H, Abraham NS, El-Serag HB. Meta-analysis: obesity and the risk for gastroesophageal reflux disease and its complications. Ann Intern Med. 2005; 143: 199-211.
2. Friedenberg FK, Xanthopoulus M, Foster GD, Richter JE. The association between gastroesophageal reflux disease and obesity. Am J Gastroenterol. 2008; 103: 2111-2122.
3. Varela JE, Hinojosa MW, Nguyen NT. Laparoscopic fundoplication compared with laparoscopic gastric bypass in morbidly obese patients with gastroesophageal reflux disease. Surg Obes Relat Dis. 2009; 5: 139-143.
4. Sise A, Friedenberg FK. A comprehensive review of gastroesophageal reflux disease and obesity. Obes Rev. 2008; 9: 194-203.
5. Csendes A, Burdiles P, Rojas J. Reflujo gastroesofágico Patológico en pacientes con obesidad severa, mórbida e hiperobesidad. Rev Med Chil. 2001; 129: 1038-1043.
6. Sammour T, Hill AG, Singh P, Ranasinghe A, Babor R, Rahman H. Laparoscopic sleeve gastrectomy as a single-stage bariatric procedure. Obes Surg. 2010; 20: 271-275.
7. Deitel M, Gagner M, Erickson AL, Crosby RD. Third International Summit: Current status of sleeve gastrectomy. Surg Obes Relat Dis. 2011; 7: 749-759.
8. Himpens J, Dapri G, Cadière GB. A prospective randomized study between laparoscopic gastric banding and laparoscopic isolated sleeve gastrectomy: results after 1 and 3 years. Obes Surg. 2006; 16: 1450-1456.
9. Pandolfino JE, El-Serag HB, Zhang Q, Shah N, Ghosh SK, Kahrilas PJ. Obesity: a challenge to esophagogastric junction integrity. Gastroenterology. 2006; 130: 639-649.
10. Chiu S, Birch DW, Shi X, Sharma AM, Karmali S. Effect of sleeve gastrectomy on gastroesophageal reflux disease: a systematic review. Surg Obes Relat Dis. 2011; 7: 510-515.
11. Mahawar KK, Jennings N, Balupuri S, Small PK. Sleeve gastrectomy

and gastro-oesophageal reflux disease: a complex relationship. Obes Surg. 2013; 23: 987-991.

12. Gagner M, Deitel M, Kalberer TL, Erickson AL, Crosby RD. The Second International Consensus Summit for Sleeve Gastrectomy. Surg Obes Relat Dis. 2009; 5: 476-485.

13. Rosenthal RJ, Diaz AA, Arvidsson D, Baker RS, Basso N, Bellanger D, et al. International Sleeve Gastrectomy Expert Panel Consensus Statement: best practice guidelines based on experience of 12,000 cases. Surg Obes Relat Dis. 2012; 8: 8-19.

14. Del Genio G, Tolone S, Limongelli P, Brusciano L, D'Alessandro A, Docimo G, et al. Sleeve Gastrectomy and Development of "De Novo" Gastroesophageal Reflux. Obes Surg. 2014; 24: 71-77.

15. Stein HJ, DeMeester TR, Peters JH, Fuchs KH. Technique, indications, and clinical use of ambulatory 24-hour gastric pH monitoring in a surgical practice. Surgery. 1994; 116: 758-766.

16. Korn O, Csendes A, Burdiles P, Braghetto I, Stein HJ. Anatomic dilatation of the cardia and competence of the lower esophageal sphincter: a clinical and experimental study. J Gastrointest Surg. 2000; 4: 398-406.

17. Braghetto I, Lanzarini E, Korn O, Valladares H, Molina JC, Henriquez A. Manometric changes of the lower esophageal sphincter after sleeve gastrectomy in obese patients. Obes Surg. 2010; 20: 357-362.

18. Braghetto I, Csendes A, Korn O, Valladares H, Gonzalez P, Henríquez A. Gastroesophageal reflux disease after sleeve gastrectomy. Surg Laparosc Endosc Percutan Tech. 2010; 20: 148-153.

19. Burgerhart JS, Schotborgh CA, Schoon EJ, Smulders JF, van de Meeberg PC, Siersema PD, et al. Effect of sleeve gastrectomy on gastroesophageal reflux. Obes Surg. 2014; 24: 1436-1441.

20. Petersen WV, Meile T, Küper MA, Zdichavsky M, Königsrainer A, Schneider JH. Functional importance of laparoscopic sleeve gastrectomy for lower esophageal sphincter in patients with morbid obesity. Obes Surg. 2012; 22: 360-366.

21. Kleidi E, Theodorou D, Albanopoulos K, Menenakos E, Karvelis MA, Papailiou J, et al. The effect of laparoscopic sleeve gastrectomy on the antireflux mechanism: can it be minimized? Surg Endosc. 2013; 27: 4625-4630.

22. Rebecchi F, Allaix ME, Giaccone C, Ugliono E, Scozzari G, Morino M. Gastroesophageal reflux disease and laparoscopic sleeve gastrectomy: a physiopathologic evaluation. Ann Surg. 2014; 260: 909-914.

23. Gorodner V, Buxhoeveden R, Clemente G, Solé L, Caro L, Grigaites A. Does laparoscopic sleeve gastrectomy have any influence on gastroesophageal reflux disease? Preliminary results. Surg Endosc. 2015; 29: 1760-1768.

24. Hayat JO, Wan A. The effects of sleeve gastectomy on gastro-esophageal reflux and gastro-esophageal motility. Expert Rev Gastroenterol Hepatol. 2014; 8: 445-452.

25. Tai CM, Huang CK, Lee YC, Chang CY, Lee CT, Lin JT. Increase in gastroesophageal reflux disease symptoms and erosive esophagitis 1 year afterlaparoscopic sleeve gastrectomy among obese adults. Surg Endosc. 2013; 27: 1260-1266.

26. Yehoshua RT, Eidelman LA, Stein M, Fichman S, Mazor A, Chen J, et al. Laparoscopic sleeve gastrectomy: volume and pressure assessment. Obes Surg. 2008; 18: 1083-1088.

27. Mion F, Tolone S, Garros A, Savarino E, Pelascini E, Robert M, et al. High-resolution Impedance Manometry after Sleeve Gastrectomy: Increased Intragastric Pressure and Reflux are Frequent Events. Obes Surg. 2016; 26: 2449-2456.

28. Tolone S, Savarino E, Yates RB. The impact of bariatric surgery on esophageal function. Ann N Y Acad Sci. 2016; 138: 98-103.

29. Tolone S, Savarino E, de Bortoli N, Frazzoni M, Furnari M, d'Alessandro A, et al. Esophagogastric junction morphology assessment by high resolution manometry in obese patients candidate to bariatric surgery. Int J Surg. 2016; 28: S109-113.

30. Tolone S, de Cassan C, de Bortoli N, Roman S, Galeazzi F, Salvador R, et al. Esophagogastric junction morphology is associated with a positive impedance-pH monitoring in patients with GERD. Neurogastroenterol Motil. 2015; 27: 1423-1431.

31. Himpens J, Dobbeleir J, Peeters G. Long term results of laparoscopic sleeve gastrectomy for obesity. Ann Surg. 2010; 252: 319-324.

32. Oor JE, Roks DJ, Ünlü Ç, Hazebroek EJ. Laparoscopic sleeve gastrectomy and gastroesophageal reflux disease: a systematic review and meta-analysis. Am J Surg. 2016; 211: 250-267.

33. Sharma A, Aggarwal S, Ahuja V, Bal C. Evaluation of gastroesophageal reflux before and after sleeve gastrectomy using symptom scoring, scintigraphy, and endoscopy. Surg Obes Relat Dis. 2014; 10: 600-605.

34. Weiner RA, Theoridou S, Weiner S. Failure of laparoscopic gastrectomy-further procedure. Obes Facts. 2011; 4: 42-46.

35. Lacy A, Ibarzabal A, Pando E, Adelsdolfer C, Delitala A, Corcelles R, et al. Revisional surgery after sleeve gastrectomy. Surg Laparosc Endosc Percutan Tech. 2010; 20: 351-356.

36. Felsenreich DM, Kefurt R, Schermann M, Beckerhinn P, Kristo I, Krebs M, et al. Reflux, Sleeve Dilation and Barrett's Esophagus after Laparoscopic Sleeve Gastrectomy: Long-Term Follow-Up. Obes Surg. 2017; 2748-2749.

37. Genco A, Soricelli E, Casella G, Maselli R, Castagneto-Gissey L, Di Lorenzo N, Basso N. Gastroesophageal reflux disease and Barrett's esophagus after laparoscopic sleeve gastrectomy: a possible, underestimated long-term complication. Surg Obes Relat Dis. 2017; 13: 568-574.

38. Samakar K, McKenzie TJ, Tavakkoli A, Vernon AH, Robinson MK, Shikora SA. The Effect of Laparoscopic Sleeve Gastrectomy with Concomitant Hiatal Hernia Repair on Gastroesophageal Reflux Disease in the Morbidly Obese. Obes Surg. 2016; 26: 61-66.

39. Soricelli E, Casella G, Rizzello M, Calì B, Alessandri G, Basso N. Initial experience with laparoscopic crural closure in the management of hiatal hernia in obese patients undergoing sleeve gastrectomy. Obes Surg. 2010; 20: 1149-1153.

40. Mahawar KK, Carr WR, Jennings N, Balupuri S, Small PK. Simultaneous sleeve gastrectomy and hiatus hernia repair: a systematic review. Obes Surg. 2015; 25: 159-166.

41. Nadaleto BF, Herbella FA, Patti MG. Gastroesophageal reflux disease in the obese: Pathophysiology and treatment. Surgery. 2016; 159: 475-486.

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