

ORIGINAL ARTICLE

Results following laparoscopic sleeve gastrectomy in elderly obese patients: a single center experience with follow-up at three years

Paolo BIANCO¹, Antonia RIZZUTO², Nunzio VELOTTI¹, Alessio BOCCHETTI¹, Domenico MANZOLILLO¹, Paola MAIETTA¹, Marco MILONE¹, Maurizio AMATO¹, Giovanni CONZO³, Oreste BUONOMO⁴, Giuseppe PETRELLA⁴, Mario MUSELLA^{1*}

¹Department of Advanced Biomedical Sciences, Federico II University, Naples, Italy; ²Department of Medical and Surgical Sciences, Magna Græcia University, Catanzaro, Italy; ³Department of Cardiothoracic and Respiratory Sciences, Luigi Vanvitelli University, Naples, Italy; ⁴Department of Surgery, Tor Vergata University, Rome, Italy

*Corresponding author: Mario Musella, Department of Advanced Biomedical Sciences, Federico II University, Via S. Pansini 5, 80131 Naples, Italy. E-mail: mario.musella@unina.it

ABSTRACT

BACKGROUND: Laparoscopic sleeve gastrectomy (LSG) represents the most performed bariatric surgical procedure worldwide. Morbid Overweight in elderly patients is becoming a significant health problem even in Italy. As well as in younger age groups, bariatric surgery could be indicated even in this subset of patients. However the advantages and results of LSG in patients over 60 years old have received minimal attention.

METHODS: The records of 375 patients underwent LSG between 2008 and 2016 were reviewed. In the entire series 18 patients were aged 60 years or older at the time of surgery. Since a 3 years follow-up was available for 12 patients out of the 18 aged over 60 we included in the study only these. General epidemiologic data, clinical findings, BMI and comorbidities surgical treatment and follow-up data were collected; postoperative measurements such as operative time, intraoperative complications, mortality rate, length of stay, incidence of early and late complications, Body mass Index (BMI), excess weight loss rate (EWL%) and comorbidities resolution were also recorded.

RESULTS: LSG was successfully performed for all geriatric patients. Global complications rate was 16.6%. At 3 years mean BMI was 34.4 ± 3.8 with a mean EWL% 66.1 ± 31.9 . Postoperative resolution of obesity comorbidities was observed; Hypertension (71.4%), type 2 Diabetes Mellitus (T2DM) (50.0%), obstructive sleep apnea syndrome (OSAS) (66.6%) respectively. No intraoperative complications or mortality were recorded.

CONCLUSIONS: LSG offered cure in geriatric patients affected by morbid obesity for weight loss and comorbidities resolution. Larger studies are necessary to analyze and minimize the incidence of postoperative complications associated to this surgical procedure in elderly patients.

(Cite this article as: Bianco P, Rizzuto A, Velotti N, Bocchetti A, Manzolillo D, Maietta P, *et al.* Results following laparoscopic sleeve gastrectomy in elderly obese patients: a single center experience with follow-up at three years. *Minerva Chir* 2020;75:77-82. DOI: 10.23736/S0026-4733.18.07757-X)

KEY WORDS: Gastrectomy; Obesity; Laparoscopy.

Obesity is a world health problem and it is associated with development, also in experimental studies, of a lot of comorbidities such as diabetes mellitus, hypertension, fatty liver, congestive heart failure, sleep apnea and infertility.¹⁻³ LSG represents worldwide the most com-

mon surgical procedure for treatment of morbid obesity. Patients undergoing LSG show an excellent excess weight loss rate (EWL%) in short- and mid-term, comparable to those undergoing standard Roux-Y gastric bypass and the most recent Mini-One Anastomosis gastric bypass

(MGB/OAGB).⁴⁻⁸ Bariatric surgery is indicated for BMI greater than 40 kg/m² or greater than 35 kg/m² presenting with comorbidities⁹⁻¹¹ and in many centers, surgery is limited to patients younger than 65 years of age.^{12, 13}

Age is considered to be an independent prognostic factor in addition to BMI, presence of diabetes mellitus and smoking in predicting bariatric postoperative morbidity and mortality as well as in general and oncological surgery.¹⁴⁻¹⁷ Elderly patients represent a large cohort of obese patients, and in Italy the prevalence increased of about 7% in the last 20 years,¹⁸ reaching 16%.

Furthermore Italian Society for Bariatric and Metabolic Surgery (SICOB), recommends bariatric surgery in obese elderly patients younger than 70 years old.¹⁹ Therefore in the current report we evaluated the adequacy of LSG in elderly patients ranging between 60 and 70 years old. The outcome of a subgroup of patients reaching a mid term follow-up (3 years) has been thus evaluated.

Materials and methods

From January 2008 to December 2016, 375 morbid obese patients underwent LGS for morbid obesity at University Hospital Federico II of Naples. Eighteen patients in the entire series were aged 60 years or more; 12 reached at least three years of follow and were then retrospectively studied.

All patients were administered preoperative intravenous low-dose heparin infusion and intraoperative pneumatic leg compression for prevention of pulmonary embolism (PE) and deep venous thrombosis (DVT), according to the SICOB guidelines.^{19, 20}

LSG was performed according to the standard surgical technique,^{11, 21} and fibrin sealant was routinely used on staple line.²² Data collected were; demographics, surgery (operative time, conversion rate), hospital stay, and complications. Among them, we investigated early complications, occurring within the first 30 days from surgery such as suture line leak and significant bleeding, and late complications such as stenosis, de novo gastro-esophageal reflux (GERD), weight regain and excessive

weight loss, occurring later than 30 days from surgery.

A structured follow-up that included periodical visits was provided for all patients. Information about weight loss, dietetic program compliance and late complication rate were investigated. Controls were scheduled every three months during the first postoperative year and every six months thereafter. T2DM and hypertension remission/resolution, were studied according to standard criteria.¹¹

Results

Male patients were 5/12 (41.6%), mean age was 65.5 years while mean preoperative BMI was 48.2±3.4 kg/m². Four patients had no comorbid diseases; T2DM (8 cases 66.6%), hypertension (7 cases 58.3%), OSAS (6 cases 50.0%) and Hiatal Hernia (6 cases 50.0%) were the most common comorbidities observed in this series of geriatric patients. Baseline parameters are shown in Table I.

All the procedures were performed by laparoscopy by the same surgeons, (MM, MM, PB), no conversion to open surgery or intraoperative complications occurred. Mean operative time was 79.1±12.0 minutes. Mean of hospital stay was 5.08±0.51 days. No mortality was recorded. Global complication rate was 16.6% (2/12). One staple line leak (8.3%) occurred as early complication two weeks after discharge from hospital and the patient had typical symp-

TABLE I.—*Baseline measurements.*

Patients	Age	Gender	BMI (kg/m ²)	Hypertension	T2DM	OSAS	Hiatal hernia
1	66	M	50	No	Yes	Yes	No
2	64	M	44	Yes	Yes	Yes	No
3	66	F	51	Yes	No	No	Yes
4	67	M	48	Yes	Yes	No	Yes
5	61	M	51	No	Yes	Yes	Yes
6	67	F	44	Yes	No	No	No
7	63	F	54	Yes	Yes	Yes	Yes
8	66	M	48	No	Yes	Yes	Yes
9	69	F	48	No	Yes	No	Yes
10	68	F	51.7	Yes	No	Yes	No
11	67	F	43.7	No	Yes	No	No
12	62	F	45	Yes	No	No	No

BMI: Body Mass Index; T2DM: Type 2 diabetes mellitus; OSAS: obstructive sleep apnea syndrome.

This document is protected by international copyright laws. No additional reproduction is authorized. It is permitted for personal use to download and save only one copy of this Article. It is not permitted to make additional copies (either sporadically or systematically, either printed or electronic) of the Article for any purpose. It is not permitted to distribute the electronic copy of the article through online internet and/or intranet file sharing systems, electronic mailing or any other means which may allow access to the Article. The use of all or any part of the Article for any Commercial Use is not permitted. The production of derivative works from the Article is not permitted. It is not permitted to remove, cover, overlay, obscure, block, or change any copyright notices or terms of use which the Publisher may post on the Article. It is not permitted to frame or use framing techniques to enclose any trademark, logo, or other proprietary information of the Publisher.

TABLE II.—*Postoperative measurements.*

Patients	Operative Time	POD	Complications	Treatment	BMI 1 year	EWL% 1 year	BMI 2 years	EWL% 2 years	BMI 3 years	EWL% 3 years	Complications resolution at 3 years		
											Hypertension	T2DM	OSAS
1	90 [°]	5	/	/	44.4	21.7	41.67	31.9	38.6	43.5	/	No	Yes
2	80 [°]	5	/	/	38.2	30.6	28.4	80.6	26.8	88.7	Yes	Yes	Yes
3	100 [°]	6	/	/	42.9	28.8	38.8	45.2	35.8	54.8	Yes	/	/
4	75 [°]	5	/	/	40.3	32.3	38	41.5	36.9	46.2	No	No	/
5	85 [°]	5	Leak	Endoscopy	40.3	38.4	37.5	48.7	35.4	56.4	/	No	Yes
6	80 [°]	4	/	/	40.8	15.4	38	28.8	34	44.2	Yes	/	/
7	90 [°]	5	Reflux	MGB	49.5	14.9	42.7	36.5	36.7	55.4	Yes	Yes	Yes
8	60 [°]	5	/	/	44.08	16.7	40.49	31.9	36.5	48.6	/	No	No
9	70 [°]	6	/	/	44.8	13.6	40.4	31.8	36	50	/	Yes	/
10	75 [°]	5	/	/	48.9	10.3	42.5	33.3	38.2	48.7	No	/	No
11	85 [°]	5	/	/	38.8	25	33.6	51.8	29.4	73.2	/	Yes	/
12	60 [°]	5	/	/	36.6	39.3	31.6	62.5	29.3	73.2	Yes	/	/

POD: postoperative days; BMI: Body Mass Index; EWL%: Excess weight loss %; T2DM: type 2 diabetes mellitus; OSAS: obstructive sleep apnea syndrome.

toms (fever >38 °C, abdominal pain and WBC count >16,000). He was treated with the placement of a Megastent® (Taewoong Medical Industries, Kangseo-Gu Songjung-Dong, South Korea).²³ Seven days after stent placement, he started a liquid high protein diet followed by a soft diet, and 3 days later, he was discharged in good clinical conditions. The stent was removed 8 weeks later, and upper endoscopy documented complete healing of the leak. One severe de novo GERD (8.3%), resistant to PPI therapy, occurred one month after LSG. Patient underwent conversion to MGB/OAGB. Postoperative course was regular and GERD symptoms were completely controlled. No further complications occurred in the remaining 10 patients.

At 1 year of follow-up mean BMI was 42.4±4.0, EWL% was 26.5±6.3. At 2 years of follow-up mean BMI was 37.8±4.4, EWL% was 56.2±34.4.

At 3 years of follow-up mean BMI was 34.4±3.8 and EWL% was 66.1±31.9. In terms of comorbidities, hypertension remission occurred in 71.4% (5/7), TDM2 remission occurred in 50.0% (4/8), OSAS remission occurred in 66.6% (4/6). Results are shown in Table II.

Discussion

In this manuscript we report on our experience using LSG in 375 patients with morbid obesity recruited between 2008 and 2016. Eighteen pa-

tients were aged 60 years or older and for 12 patients a three years follow-up was available. The most relevant conclusion from our study is that LSG in an effective procedure in the treatment of morbid obesity in elderly patients not previously selected. This report demonstrates the safety of LGS in geriatric patients. Although LSG is known to be technically easier and with better outcomes if compared to the other bariatric procedures,¹³ the results of this procedure on elderly patients have received minimal attention. The patients older than 65 years represents over 40% of all surgeries performed²⁴ and the overweight management, is an important aspect for this subset of patients.

In the USA, the age-adjusted prevalence of obesity in 2013-2014 was 35% among men and 40% among women.²⁵ Similarly, in Italy, the prevalence of obesity among the elderly increased in the last 10 years.²⁶ In elderly adults, excess weight is associated with a higher prevalence of many chronic health conditions and reduced quality of life. Nowadays bariatric surgery demonstrates to be the most effective treatment for morbid obesity and its comorbidities.²⁷ For many years, advanced age has been a relative contraindication to bariatric surgery because of increased perioperative risk and suboptimal excess weight loss,^{28, 29} or late complications leading to neurological manifestations.^{30, 31}

The Obesity Society/American Society for Metabolic & Bariatric Surgery/American As-

sociation of Clinical Endocrinologists Clinical Practice Guidelines established, in the 2013 update, criteria of eligibility for bariatric surgery but without defining a clear age limit.^{32, 33} Various bariatric programs have established arbitrary cutoff levels for age at 65-70 years.³⁴

Van Rutte *et al.* and Soto *et al.* have shown LSG to be safe and effective procedure in terms of weight loss and comorbidity resolution in elderly patients.^{35, 36} Considering the safety profile and better results, Carlin *et al.* demonstrated LSG to be a better alternative to Laparoscopic Roux-en-Y gastric bypass (LRYGB) and LAGB.³⁷

Casillas *et al.* found that adult patients >65 years lost significantly more weight with LRYGB than LSG (66.1% versus 42.3% EWL), but LRYGB had a longer length of stay and higher major early and late complication rates compared to LSG.³⁸

Navarrate *et al.* reported LSG to be a safe and feasible procedure in the elderly, showing results comparable to younger bariatric population. Although weight loss may be not as high as in younger patients, it is still acceptable and successful as well as remission of comorbidities.³⁹

Keren *et al.* suggest that long-term weight loss, improvements in comorbidity, and compliance to follow-up are significant for the patients over 55 years old undergoing LSG⁴⁰ while Garofalo suggests that age limit for bariatric surgery (especially for LSG) can be extended to patients over 65 years old, with good results in terms of morbidity, mortality, comorbidities reduction, and weight loss.³² Our data support results from these previous studies. We found an acceptable EWL% at 3 years, lower than in our standard population,¹⁸ and a good remission rate from T2DM, hypertension and OSAS, similar to our standard cohort.¹¹

For what concerns early and late complications associated, the presence of GERD and/or hiatal hernia is considered a relative contraindication for the execution of LSG. In these cases gastric bypasses (RYGB or OAGB) seems constitute a more suitable options.⁴¹

Weiner *et al.* noticed that 15% of the patients who underwent LSG had severe GERD that necessitated revision to RYGB or MGB/OAGB.⁴² We recorded in our series 1/12 *de novo* GERD

(8.3%), a complication rate finally comparable with other larger series in a population of standard age.⁴³

One patient in our study (8.3%) presented a leak. Even though an early surgical re-exploration is indicated when surgeons suspect an acute leak,⁴⁴ it was conservatively managed. This was because the leak presented two weeks following discharge from hospital and the patient, although symptomatic, was in stable hemodynamic condition^{6, 45, 46}.

In our experience, confirming most recent published evidence,⁴⁷ LSG demonstrated to be safe and effective in obese elderly patients in terms of comorbidities resolution, showing an acceptable EWL%. Early and late complications, presenting a prevalence rate comparable to standard aged population, could be treated as well as in younger patients. The few cases recorded in our study remain a limiting factor.

Conclusions

LSG is safe and effective for the treatment of morbid obesity in elderly patients. Age does not seem to be an independent prognostic factor of success or failure. Larger studies are necessary to analyze and minimize the incidence of postoperative complications associated to this surgical procedure in old age.

References

1. Musella M, Milone M, Gaudioso D, Bianco P, Palumbo R, Galloro G, *et al.* A decade of bariatric surgery. What have we learned? Outcome in 520 patients from a single institution. *Int J Surg* 2014;12(Suppl 1):S183-8.
2. Parafati M, Lascala A, Morittu VM, Trimboli F, Rizzuto A, Brunelli E, *et al.* Bergamot polyphenol fraction prevents nonalcoholic fatty liver disease via stimulation of lipophagy in cafeteria diet-induced rat model of metabolic syndrome. *J Nutr Biochem* 2015;26:938-48.
3. Musella M, Milone M, Bellini M, Sosa Fernandez LM, Leongito M, Milone F. Effect of bariatric surgery on obesity-related infertility. *Surg Obes Relat Dis* 2012;8:445-9.
4. Berger ER, Clements RH, Morton JM, Huffman KM, Wolfe BM, Nguyen NT, *et al.* The Impact of Different Surgical Techniques on Outcomes in Laparoscopic Sleeve Gastrectomies: The First Report from the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP). *Ann Surg* 2016;264:464-73.
5. Benaiges D, Más-Lorenzo A, Goday A, Ramon JM, Chillarón JJ, Pedro-Botet J, *et al.* Laparoscopic sleeve gastrectomy: more than a restrictive bariatric surgery procedure? *World J Gastroenterol* 2015;21:11804-14.

6. Rosenthal RJ, Diaz AA, Arvidsson D, Baker RS, Basso N, Bellanger D, *et al.*; International Sleeve Gastrectomy Expert Panel. 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.
7. Musella M, Susa A, Greco F, De Luca M, Manno E, Di Stefano C, *et al.* The laparoscopic mini-gastric bypass: the Italian experience: outcomes from 974 consecutive cases in a multicenter review. *Surg Endosc* 2014;28:156–63.
8. Milone M, Di Minno MN, Leongito M, Maietta P, Bianco P, Taffuri C, *et al.* Bariatric surgery and diabetes remission: sleeve gastrectomy or mini-gastric bypass? *World J Gastroenterol* 2013;19:6590–7.
9. Yoon J, Sherman J, Argiroff A, Chin E, Herron D, Inabnet W, *et al.* Laparoscopic Sleeve Gastrectomy and Gastric Bypass for The Aging Population. *Obes Surg* 2016;26:2611–5.
10. Cummings DE, Cohen RV. Beyond BMI: the need for new guidelines governing the use of bariatric and metabolic surgery. *Lancet Diabetes Endocrinol* 2014;2:175–81.
11. Musella M, Apers J, Rheinwalt K, Ribeiro R, Manno E, Greco F, *et al.* Efficacy of Bariatric Surgery in Type 2 Diabetes Mellitus Remission: the Role of Mini Gastric Bypass/One Anastomosis Gastric Bypass and Sleeve Gastrectomy at 1 Year of Follow-up. A European survey. *Obes Surg* 2016;26:933–40.
12. Praveenraj P, Gomes RM, Kumar S, Perumal S, Senthilnathan P, Parthasarathi R, *et al.* Comparison of weight loss outcomes 1 year after sleeve gastrectomy and Roux-en-Y gastric bypass in patients aged above 50 years. *J Minim Access Surg* 2016;12:220–5.
13. Hutter MM, Schirmer BD, Jones DB, Ko CY, Cohen ME, Merkow RP, *et al.* First report from the American College of Surgeons Bariatric Surgery Center Network: laparoscopic sleeve gastrectomy has morbidity and effectiveness positioned between the band and the bypass. *Ann Surg* 2011;254:410–20, discussion 420–2.
14. Scozzari G, Passera R, Benvenega R, Toppino M, Morino M. Age as a long-term prognostic factor in bariatric surgery. *Ann Surg* 2012;256:724–8, discussion 728–9.
15. Livingston EH, Huerta S, Arthur D, Lee S, De Shields S, Heber D. Male gender is a predictor of morbidity and age a predictor of mortality for patients undergoing gastric bypass surgery. *Ann Surg* 2002;236:576–82.
16. Mechanick JI, Youdim A, Jones DB, Garvey WT, Hurley DL, McMahon MM, *et al.*; American Association of Clinical Endocrinologists; Obesity Society; American Society for Metabolic & Bariatric Surgery. 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):S1–27.
17. Milone M, Elmore U, Di Salvo E, Delrio P, Bucci L, Ferulano GP, *et al.* Intracorporeal versus extracorporeal anastomosis. Results from a multicentre comparative study on 512 right-sided colorectal cancers. *Surg Endosc* 2015;29:2314–20.
18. Musella M, Milone M, Maietta P, Bianco P, Coretti G, Pisapia A, *et al.* Bariatric surgery in elderly patients. A comparison between gastric banding and sleeve gastrectomy with five years of follow up. *Int J Surg* 2014;12(Suppl 2):S69–72.
19. Sicob: [Internet]. Available from: www.sicob.org [cited 2017, May 25].
20. Kakkos SK, Caprini JA, Geroulakos G, Nicolaidis AN, Stansby G, Reddy DJ, *et al.* Combined intermittent pneumatic leg compression and pharmacological prophylaxis for prevention of venous thromboembolism. *Cochrane Database Syst Rev* 2016;9:CD005258.
21. Musella M, Milone M, Bellini M, Leongito M, Guarino R, Milone F. Laparoscopic sleeve gastrectomy. Do we need to oversee the staple line? *Ann Ital Chir* 2011;82:273–7.
22. Musella M, Milone M, Maietta P, Bianco P, Pisapia A, Gaudioso D. Laparoscopic sleeve gastrectomy: efficacy of fibrin sealant in reducing postoperative bleeding. A randomized controlled trial. *Updates Surg* 2014;66:197–201.
23. Galloro G, Magno L, Musella M, Manta R, Zullo A, Forestieri P. A novel dedicated endoscopic stent for staple-line leaks after laparoscopic sleeve gastrectomy: a case series. *Surg Obes Relat Dis* 2014;10:607–11.
24. Rizzuto A, Serra R, Mignogna C, Palaia I, Zittel FU, Sacco R. Single incision laparoscopic cholecystectomy in geriatric patients. *Int J Surg* 2016;35:83–7.
25. Flegal KM, Kruszon-Moran D, Carroll MD, Fryar CD, Ogden CL. Trends in Obesity Among Adults in the United States, 2005 to 2014. *JAMA* 2016;315:2284–91.
26. Barbieri M, Désesquelles A, Egidi V, Demuru E, Frova L, Meslé F, *et al.* Obesity-related mortality in France, Italy, and the United States: a comparison using multiple cause-of-death analysis. *Int J Public Health* 2017;62:623–9.
27. Golzarand M, Toolabi K, Farid R. The bariatric surgery and weight losing: a meta-analysis in the long- and very long-term effects of laparoscopic adjustable gastric banding, laparoscopic Roux-en-Y gastric bypass and laparoscopic sleeve gastrectomy on weight loss in adults. *Surg Endosc* 2017;31:4331–45.
28. Flum DR, Salem L, Elrod JA, Dellinger EP, Cheadle A, Chan L. Early mortality among Medicare beneficiaries undergoing bariatric surgical procedures. *JAMA* 2005;294:1903–8.
29. Livingston EH, Langert J. The impact of age and Medicare status on bariatric surgical outcomes. *Arch Surg* 2006;141:1115–20, discussion 1121.
30. Milone M, Di Minno MN, Lupoli R, Maietta P, Bianco P, Pisapia A, *et al.* Wernicke encephalopathy in subjects undergoing restrictive weight loss surgery: a systematic review of literature data. *Eur Eat Disord Rev* 2014;22:223–9.
31. Scarano V, Milone M, Di Minno MN, Panariello G, Bertogliatti S, Terracciano M, *et al.* Late micronutrient deficiency and neurological dysfunction after laparoscopic sleeve gastrectomy: a case report. *Eur J Clin Nutr* 2012;66:645–7.
32. Garofalo F, Denis R, Pescarus R, Atlas H, Bacon SL, Garneau P. Long-term outcome after laparoscopic sleeve gastrectomy in patients over 65 years old: a retrospective analysis. *Surg Obes Relat Dis* 2017;13:1–6.
33. Mechanick JI, Youdim A, Jones DB, Timothy Garvey W, Hurley DL, Molly McMahon M, *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. *Surg Obes Relat Dis* 2013;9:159–91.
34. DeMaria EJ, Portenier D, Wolfe L. Obesity surgery mortality risk score: proposal for a clinically useful score to predict mortality risk in patients undergoing gastric bypass. *Surg Obes Relat Dis* 2007;3:134–40.
35. van Rutte PW, Smulders JF, de Zoete JP, Nienhuijs SW. Sleeve gastrectomy in older obese patients. *Surg Endosc* 2013;27:2014–9.
36. Soto FC, Gari V, de la Garza JR, Szomstein S, Rosenthal RJ. Sleeve gastrectomy in the elderly: a safe and effective

procedure with minimal morbidity and mortality. *Obes Surg* 2013;23:1445–9.

37. Carlin AM, Zeni TM, English WJ, Hawasli AA, Genaw JA, Krause KR, *et al.*; Michigan Bariatric Surgery Collaborative. The comparative effectiveness of sleeve gastrectomy, gastric bypass, and adjustable gastric banding procedures for the treatment of morbid obesity. *Ann Surg* 2013;257:791–7.

38. Casillas RA, Kim B, Fischer H, Zelada Getty JL, Um SS, Coleman KJ. Comparative effectiveness of sleeve gastrectomy versus Roux-en-Y gastric bypass for weight loss and safety outcomes in older adults. *Surg Obes Relat Dis* 2017;13:1476–83.

39. Navarrete A, Corcelles R, Del Gobbo GD, Perez S, Vidal J, Lacy A. Sleeve gastrectomy in the elderly: A case-control study with long-term follow-up of 3 years. *Surg Obes Relat Dis* 2017;13:575–80.

40. Keren D, Matter I, Rainis T. Sleeve Gastrectomy in Different Age Groups: a Comparative Study of 5-Year Outcomes. *Obes Surg* 2016;26:289–95.

41. Dakour Aridi H, Asali M, Fouani T, Alami RS, Safadi BY. Gastroesophageal Reflux Disease After Laparoscopic Sleeve Gastrectomy with Concomitant Hiatal Hernia Repair: an Unresolved Question. *Obes Surg* 2017;27:2898–904.

42. Weiner RA, Theodoridou S, Weiner S. Failure of laparoscopic sleeve gastrectomy—further procedure? *Obes Facts* 2011;4(Suppl 1):42–6.

43. 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;211:250–67.

44. Musella M, Milone M, Bianco P, Maietta P, Galloro G. Acute Leaks Following Laparoscopic Sleeve Gastrectomy: Early Surgical Repair According to a Management Algorithm. *J Laparoendosc Adv Surg Tech A* 2016;26:85–91.

45. Parikh M, Issa R, McCrillis A, Saunders JK, Ude-Welcome A, Gagner M. Surgical strategies that may decrease leak after laparoscopic sleeve gastrectomy: a systematic review and meta-analysis of 9991 cases. *Ann Surg* 2013;257:231–7.

46. Casella G, Soricelli E, Rizzello M, Trentino P, Fiocca F, Fantini A, *et al.* Nonsurgical treatment of staple line leaks after laparoscopic sleeve gastrectomy. *Obes Surg* 2009;19:821–6.

47. Wang Y, Yi X, Li Q, Zhang J, Wang Z. The Effectiveness and Safety of Sleeve Gastrectomy in the Obese Elderly Patients: a Systematic Review and Meta-Analysis. *Obes Surg* 2016;26:3023–30.

Conflicts of interest.—The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Authors' contributions.—Paolo Bianco and Nunzio Velotti: conception and design, drafting the article. Antonia Rizzuto drafting the article, revising it critically: acquisition, analysis and interpretation of data. Alessio Bocchetti, Domenico Manzolino, Maurizio Amato and Marco Milone: acquisition and analysis of data. Giovanni Conzo, Oreste Buonomo and Giuseppe Petrella: revising article critically. Mario Musella: conception and design, interpretation of data, revising article critically. All authors have read and approved the final manuscript.

History.—Article first published online: June 29, 2018. - Manuscript accepted: June 19, 2018. - Manuscript received: March 30, 2018.