Laparoscopic Sleeve Gastrectomy: Beyond the 10 years

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1 Introduction

The laparoscopic sleeve gastrectomy (LSG) was introduced initially as the first step of a staged procedure for high risk super-obese patients to be later followed by Roux-en-Y gastric bypass (RYGB) or duodenal switch (DS) [1]. The initial experiences and results with the LSG at that time suggested that it has the potential to be considered as a stand-alone single stage bariatric operation [2].

The LSG became extremely popular over the following years. Initially it constituted 5% of all bariatric procedures , as reported by the 2008 IFSO survey (International Federation for the Surgery of Obesity and related disorders), afterwards, the LSG dominated the bariatric field in 2016 and constituted 50% of all primary bariatric procedures [3] Fig. 1.

This trend can be explained by the fact that the LSG is seemingly easy and likey has a lower learning curve compared to the other procedures, especially that it was reported to have a slightly lower 30 days adverse outcome rate compared to the RYGB [4].

The safety profile and good short term outcomes are not enough. The lack of longterm data, particularly 10 years follow up, became an area of crticisim and debate. Longterm weight loss outcomes, the rate of weight regain, resolution of comorbidities, the risk of gastroesophageal reflux disease, and the need for reoperation became the pilars of this ongoing debate.

In this chapter we will examine the available longterm outcomes (beyond the 10 years) of the LSG.

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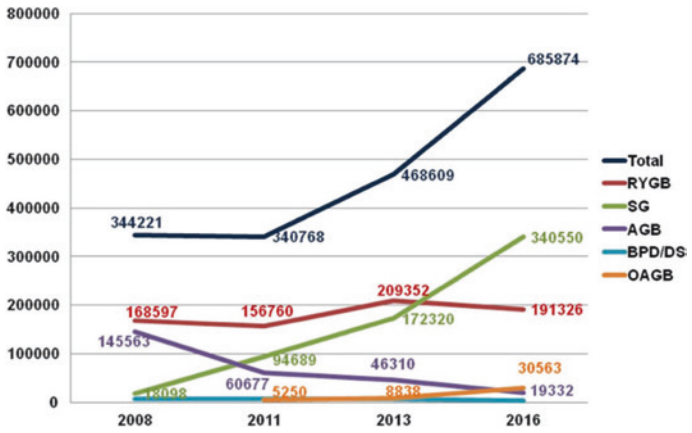

Fig. 1 Number of the main primary bariatric/metabolic surgical procedures from 2008 to 2016. AGB adjustable gastric banding, RYGB Roux-en-Y gastric bypass, SG sleeve gastrectomy, BPD-DS biliopancreatic diversionduodenal switch, OAGB oneanastomosis gastric bypass Angrisani et al. [3].

Table 1 Summary of 10 years weight loss outcomes after LSG

Study	Number of patients	% EBWL
Arman et al. [7]	47	62.5
Rodriguez et al. [8]	40	53.8
Gissey et al. [9]	114	52.5
Chang et al. [5]	65	70.5
Felsenreich et al. [6]	65	50

2 Weight Loss Outcomes

Despite the LSG's impressive short term and midterm weight loss outcomes, longterm weight loss outcomes beyond the 10 years mark are minimal, consisiting of few series and small amounts of patients.

Chang et al. reported on 65 post LSG patients with more than 10 years follow up. The perentage of excess body weight loss (%EBWL) was 70.5% [5]. A second study by Felsenreich et al. descibed the outcomes of another 65 patients who reached 10 years follow-up with only 50% EBWL [6]. Arman et al. similarly reported on 47 patients that were not converted who sustained 62.5% EBWL at 10 years [7]. Rodriguez et al. and Gissey et al. both reported on EBWL at 10 years being 53.8% in 40 patients and 52.5% in 114 patients respectively [8, 9]. To summarize, data is only available on the outcomes of 331 patients beyond 10 years with EBWL ranging between 50 and 70.5% Table 1.

3 Weight Regain

Weight regain has been descibed in 10.4% of LSG patients at 10 years [8]. The overall revision rate post LSG for all reasons was reported to be 21.5 to 33% [5–8]. Revisions for weight regain constitutes 27.5 to 81% of all revisions, with the RYGB being the most commonly performed revisional procedure post LSG for all purposes [5, 7, 8].

4 Gastroesphageal Reflux Disease Post Sleeve Gastrectomy

Gastroesophageal reflux disease (GERD) is one of the other major longterm concerns after LSG. These concerns sharply increased with the longterm de-novo GERD rate being reported between 21.4 and 58.4% at 10 years [5, 7, 8]. This significant rise in GERD, erosive esophagitis, and Barrets esophagus with no resolution of preoperative GERD at 10 years follow up led to substantially more people taking proton pump inhibitors (PPI) late after the procedure [7, 8].

With almost half of the patients (50%) consuming PPI regularly at 10 years, together with longterm GERD constituting 19–65.2% of all indications for post LSG revisions, this translated into a 16.9% conversion rate to RYGB, further highlighting GERD as a major pitfall of the LSG at 10 years [5–7] Table 2.

It is important to highlight that patients with GERD symptoms report significantly lower quality of life scores at 10 years [6].

5 Barretts Esophagus Post LSG

It is known that morbidly obese patients are more affected by GERD than lean patients. Furthermore; the duration and severity of GERD symptoms has a direct relationship to Barretts esophagus (BE). Although there is no longterm data on BE after LSG we felt it is important to disccuss the short and midterm outcome of LSG and BE in this chapter.

Table 2 Summary of all studies reporting GERD outcomes at 10 years post LSG

Study	Denovo GERD rate (%)	Coversion rate due to GERD
Arman et al. [7]	21.4	19% of all conversions
Gissey et al. [9]	42.9	1.8% of the total cohort of patients
Chang et al. [5]	58.4	65.2% of all conversions
Felsenreich et al. [6]	57	34% of all conversions

Although the diagnosis of GERD post LSG has been based on symptoms and PPI use, in 2017 Genco et al. reported on 110 post LSG patients that underwent both pre and post operative endoscopy and biopsies with a 58 months follow up. They reported 68.1% GERD symptoms and 57.2% PPI intake. This translated into a significant increase in erosive esophagitis leading to upward migration of the "Z" line in 73.6% of patients and a new diagnosis of non dysplastic BE in 17.2% of patients [10].

A follow up study by the same group with 144 patient and a mean follow up of 66 months showed an increase in GERD and PPI rate to 70.2% and 63.9% respectively. 72.9% had pathological endoscopic findings with 13.1% documentd BE [11]. This is similar to the BE rate of 14% documented by Felsenreich et al. [6].

This worrisome issue of GERD leading to the early development of BE in a young population led the International Federation for the Surgery of Obesity and related disorders (IFSO) to release a position statement on endoscopy and bariatric surgery in July 2020 stating:

> EGD should be undertaken routinely for all patients after bariatric surgery at 1 year and then every 2–3 years for patients who have undergone LSG or OAGB to enable early detection of Barrett's esophagus or upper GI malignancy until more data is available to confirm the incidence of these cancers in practice [12].

6 Comorbidities Beyond the 10 years

Comorbidities resolution should constitute the main long-term interest in bariatric surgery. Although long-term outcomes of comorbidity resolution are available for the RYGB, outcomes beyond the 10 years for LSG are minimal. We will summarize the data available on comorbidities and LSG beyond the 10 years.

The LSG showed resolution of comorbidities at 1 year with some persistence in the results at 10 years. Chang et al. reported type II diabetes (DM) remission of 60% at 1 year that drops to 39.6% at 10 years [5]. Felsenreich reported 71.4% 10 years DM resolution in 5 patients only [6]. Arman et al. reported on 3 patients with DM in their series. All 3 required revisional surgery during the follow up period (2 converted to RYGB, 1 to DS) [7]. Rodriguez reported a 54.9% improvement rate in his 40 patient's cohort. However; 33.3% required DM medications again [9]. Gissey et al. followed 17 diabetic post LSG patients and reported 64.7% DM resolution rate at 10 years.

As for Hypertension (HTN), resolution rates between 28.6 and 78.4% in very small numbers of patients have been reported [5–9]. However; 31.1% of patients had to restart HTN medications during follow up [9]. Resolution of comorbidities at 10 years after LSG is summarized in Table 3.

Table 3 Resolution rate of comorbidities at 10 years after LSG

Study	Type II DM (Remission/ Improvement at 10 years)	Hypertension (Remission/ Improvement at 10 years)	Hyperlipidemia (Remission/ Improvement at 10 years)	Obstructive sleep apnea (Remission/ Improvement at 10 years)
Chang et al.	39.6%	78.4%	51.3%	–
Felsenreich et al.	71.4% (5 patients)	36.1% (13 patients)	–	–
Arman et al.	All patients with DM required revision prior to 10 years. 1 denovo case recorded	28.6% either remission or improvement	10 patients: 2 remission 2 improvement 6 did not improve	66%
Gissey et al.	64.7%/23.5%(17 patients)	44.2%/36.5%	36.4%/45.5%	72.2%/27.8%
Rodriguez et al.	–/54.9% 33.3% of patient required medications again	–/48.2% 31.1% restarted HTN medication	–	–

7 Conclusion

The LSG has become one of the most commonly performed bariatric procedures worldwide. It has good short to mid term outcomes. Longterm results beyond the 10 years are lacking and is constituted of small series of patients. Weight regain, relapse of comorbidities that initially resloved, GERD, and Barretts esophagus are longterm concers that need to be closely observed and followed in larger series of patients to document the long term efficacy and safety of the LSG.

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Suggested Reading

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