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Review article

Long-term results after sleeve gastrectomy: A systematic review

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Abstract

Sleeve gastrectomy (SG) has become one of the most commonly used bariatric procedures worldwide. However, data regarding long-term results remain insufficient. The aim of this study was to review the long-term results after SG. We conducted a comprehensive literature search of Medline and the Cochrane Library for articles published until May 2016 on the long-term results (>5 yr) after SG. Studies representing outcomes of SG were included if they reported ≥ 5 -year results that contained at least one outcome of interest—weight loss, co-morbidities, long-term complications, or quality of life—and SG was performed as a primary procedure. Of the 297 initially identified articles, 277 studies met the exclusion criteria, and 20 met the inclusion criteria. SG was performed on 2713 patients and 1626 patients reached the ≥ 5 -year follow-up point. Among the patients, 71.3% were women and 28.7% were men. The mean preoperative body mass index was 46.9 kg/m². The duration of follow-up ranged 5 to 11 years. The mean 5-year follow-up rate was 66% (range, 57%–100%). The mean percentage excess weight loss was 58.4%, 59.5%, 56.6%, 56.4%, and 62.5% at 5, 6, 7, 8, and 11 years, respectively. Five years after SG, the resolution or improvement of type 2 diabetes was observed in 77.8% of patients, and arterial hypertension, dyslipidemia, obstructive sleep apnea, gastroesophageal reflux disease, and degenerative joint diseases had improved or resolved in 68.0%, 65.9%, 75.8%, 30.6%, and 55.7% of patients, respectively. This systematic review suggests that SG can lead to substantial and lasting excess weight loss and significant improvement in obesity-related co-morbidities. However, the lack of randomized clinical trials, low follow-up rates, and poorly reported data regarding co-morbidities and quality of life in many of the studies indicate that these findings should be interpreted with caution. (*Surg Obes Relat Dis* 2016;■:00–00.) © 2016 American Society for Metabolic and Bariatric Surgery. All rights reserved.

Keywords:

Obesity; Bariatric surgery; Sleeve gastrectomy; Long term

Over 468,000 bariatric operations were performed in 2013 worldwide. The most commonly performed procedures were laparoscopic Roux-en-Y gastric bypass (LRYGB, 45%), sleeve gastrectomy (SG, 37%), and laparoscopic adjustable gastric banding (LAGB, 10%) [1].

SG was introduced by D.W. Hess, D.S. Hess, and P. Marceau in 1988 as part of the biliopancreatic diversion with duodenal switch procedure (BPD/DS) [2–6]. Later, due to the higher perioperative morbidity and mortality rates in high-risk, super-obese patients (body mass index [BMI] >60 kg/m²), it was advocated that surgeons perform a 2-stage procedure with SG as the initial stage [7]. However, because of good weight loss results and improved co-morbidities, the second stage was performed in approximately 25% of such patients [8–10]. In the past 10 years, laparoscopic SG has

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increasingly been used as a standalone bariatric procedure in nonsuper-obese patients [1]. Compared to other bariatric operations, SG is technically less complex with a relatively short learning curve [3]. SG likely affects normal physiology less than other currently accepted standard bariatric procedures such as LRYGB and BPD/DS, as it involves no anastomosis, no anatomic bypass, and no malabsorption [3,4,11,12].

Because SG is a relatively new bariatric procedure, there are many data regarding its short-term and medium-term (< 5 yr) results; however, there is a lack of long-term (> 5 yr) results. The aim of this article was to review the long-term results after SG. A previous systematic review concerning the long-term outcomes of SG by Diamantis et al. [13] in 2014 emphasized the results of weight loss; however, data regarding long-term effect on co-morbidities were incomplete, and quality of life was not evaluated. Moreover, the quality of the data presented in reviewed studies was not evaluated.

Methods

A comprehensive literature search was conducted adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2009 Guidelines [14].

The Cochrane Controlled Trials Register Databases and Medline (PubMed) were queried for human studies published until July 2016 analyzing patients who had undergone SG. The search was conducted on May 15, 2016 using the search terms “sleeve gastrectomy” or “gastric sleeve” or “vertical sleeve” and “long term.” Ž.J. and G.B. independently performed the literature search, and the results were cross-checked to achieve consensus. Exclusion criteria included publication of case reports, abstracts only, letters, comments, reviews, or meta-analyses; duplicate studies; studies involving patients with a BMI < 35; studies involving adolescents (aged < 18 yr); and studies providing < 5-year results. Studies were included if they reported ≥ 5-year results that contained at least one outcome of interest—weight loss, co-morbidities, long-term complications, or quality of life, and SG was performed as a primary procedure. The title and abstract of each article were used to assess whether its inclusion in the study would be appropriate. For articles considered appropriate based on the abstract, the full text was obtained and again assessed to determine its appropriateness for inclusion. Of the 297 initially identified articles, 277 studies were excluded from analysis, and 20 met the inclusion criteria. The study flow chart is depicted in Figure 1. Characteristics including study type, patient age, BMI, percentage excess weight loss (%EWL), long-term complications, mortality, and changes in co-morbidities and quality of life were documented.

Weight loss was expressed by %EWL and percentage excess body mass index loss (%EBMIL). However, because %EWL and %EBMIL convey the same value when a BMI of 25 kg/m² is used to define the threshold of excess weight,

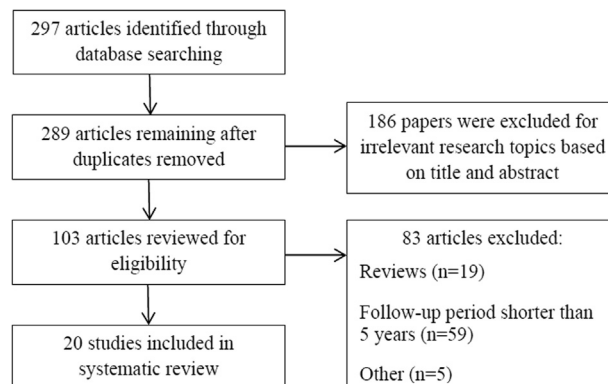


Fig. 1. Study PRISMA flow chart. PRISMA = Preferred Reporting Items for Systematic Review and Meta-Analysis.

we considered them equivalent. As the majority of reviewed studies defined the resolution of co-morbid condition as normal clinical parameters without medication and improvement as a reduction in medical therapy, these criteria were adapted to evaluate changes in co-morbidities.

Results

Twenty studies (1 randomized controlled trial and 19 retrospective) involving 2713 SG patients were included in the final analysis. The main characteristics of the studies are presented in Table 1.

The mean patient age at the time of surgery was 38 years. Among the patients, 71.3% were women and 28.7% were men. The mean preoperative BMI was 46.9 kg/m². The duration of follow-up ranged from 5 to 11 years. The mean 5-year follow-up rate was 68.4% (range, 57%–100%). Seventeen studies reported 5-year results, 5 studies reported 6-year results, 2 studies reported 7- and 8-year follow-up results, and 1 study reported 11-year results. All studies evaluated the body mass changes (Table 2) and expressed them as %EWL, except the studies of Arman et al. [15], Sieber et al. [16], Saif et al. [17], and Strain et al. [18], who reported %EBMIL. Seventeen studies involving 1501 patients reported 5-year data. The mean %EWL in this group was 58.4%. The 6-year results in the 5 studies were presented with a mean %EWL of 59.4%. The 2 studies reporting weight loss results after 7 and 8 years reported a mean %EWL of 56.6% and 54.8%, respectively. One study reported %EWL of 62.5 after 11 years. Regarding study type, there was 1 randomized controlled trial [8], and the remaining studies were retrospective.

Twelve studies estimated the effect of SG on co-morbidities after 5 years (Table 3); 11 reported the effect on type 2 diabetes; 9 on arterial hypertension; 6 on dyslipidemia; 8 on obstructive sleep apnea (OSA); 4 on degenerative joint diseases; and 9 on gastroesophageal reflux disease (GERD). Ten of the 12 studies reported the used improvement and resolution criteria. The majority of studies defined resolution as normal clinical parameters

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