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Research article

Assessing the Effectiveness of Endoscopic Sleeve Gastroplasty (ESG) Versus Intragastric Balloon Insertion (IGB): Systematic Review and Meta-Analysis

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Abstract

The global increase in obesity rates has led to more frequent use of Endoscopic Sleeve Gastroplasty (ESG) and Intragastric Balloons (IGB). This meta-analysis compares the effectiveness of ESG and IGB in weight loss. Methods:We performed a systematic review through December 2023, evaluating the impact of ESG and IGB on the percentage of total body weight loss (%TBWL) at 6 and 12 months and on adverse events, utilizing a random-effects model and I²% statistics. Results: Four studies were analyzed, comparing patients undergoing ESG to those receiving IGB. The difference in %TBWL between ESG and IGB was 1.48% (95% CI 0.67-3.64, I^2 = 70%) at six months and 3.85% (95% CI 0.70-7.01, I^2 = 77%) at 12 months. Adverse events were primarily reported in the IGB group, based on two studies. Conclusion: ESG demonstrated a higher %TBWL with fewer side effects than IGB, indicating a need for further research to comprehensively evaluate their safety and efficacy.

Keywords: Endoscopic sleeve gastroplasty, intragastric balloon, total body weight loss, preferred reporting items for systematic reviews and meta-analyses

Introduction

Endoscopic Sleeve Gastroplasty (ESG) and Intragastric Balloon (IGB) have emerged as less invasive bariatric procedures in the treatment of obesity [1,2]. ESG involves endoscopic restructuring of the stomach to reduce its volume [3], while IGB placement entails the insertion of a temporary balloon to create a feeling of fullness [4]. Both aim to induce weight loss and improve metabolic health with lower procedural risks compared to conventional bariatric surgery.

This study comprehensively compares ESG and IGB, evaluating their effectiveness, safety, and impact on obesity management, informing clinical decision-making and patient care in obesity treatment.

Material and Methods

Search strategy

We conducted a comprehensive search following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, encompassing PubMed, CINAHL, EMBASE, and Cochrane databases from inception until December 2023. In collaboration with the study authors, an expert medical librarian facilitated the development of our literature search strategy, specifically identifying studies that compared the effectiveness of ESG and IGB.

Study selection

For this meta-analysis, we included studies that compared the % of total body weight loss and adverse effects between ESG

and IGB. We considered studies from all geographic locations and accepted only full-length manuscripts.

Data abstraction and outcomes assessed

Two authors (SM, PL) independently abstracted data on study outcomes from the individual studies in a standardized form. Our primary outcome was the percentage loss of total body weight between ESG and IGB at 3, 6, and 12-month intervals. We also examined the adverse events.

Statistical analysis

We employed a random-effects model for meta-analysis, following standard methodologies. For zero-incidence outcomes, a 0.01 correction was added pre-analysis [5]. Heterogeneity was evaluated using Cochrane Q and I^2 statistics, with I^2 values categorizing heterogeneity as low (<30%), moderate (30%–60%), substantial (61%–75%), or considerable (>75%). The 95% prediction interval was calculated to address effect variance [6].

Results

Search results and population characteristics

From a total of 54 citations identified by our literature search, four studies [7-10] were included in the final meta-analysis. The schematic diagram of the study selection is illustrated in Supplementary Appendix 1.

Characteristics and quality of included studies

Supplementary Table 1 provides baseline characteristics of the four studies included in our analysis. Among these, two were conducted in Spain, and one in the United States and Poland. The study designs were predominantly retrospective, with three retrospective and one prospective study. The majority were conducted at single centers, with only one spanning multiple centers. A total of 451 patients underwent ESG, while 629 received IGB placement. The gender distribution was predominantly female, with 71.2% in the ESG cohort and 88.1% in the IGB group. The average age was similar between groups, at 45.9 years for ESG and 45.3 years for the IGB group. Pre-procedure, the mean Body Mass Index (BMI) was 41.3 kg/m2 for the ESG group and slightly lower at 35.9 kg/m^2 for the IGB group.

Meta-analysis and Systematic Review Outcomes

The difference in % weight loss between IGB and ESG at 6 months

In our meta-analysis of 4 studies, we found that the differential in % TBWL with ESG minus that of IGB at 6 and 12 months post-procedure was 1.48% (95% CI 0.67-3.64, $I^2 = 70\%$), Forest plot, Supplementary Figure 1.

The difference in % weight loss between IGB and ESG at 12 months

In our meta-analysis of 4 studies, we found that the difference in % TBWL with ESG minus that of IGB at 6 and 12 months post-procedure was 3.85% (95% CI 0.70-7.01, $I^2 = 77\%$) respectively, Forest plot, Figure 2.

The Adverse Events between IGB and ESG

In our analysis, reporting of adverse events was limited to only two studies. Petriczko et al. documented 19 adverse events out of 185 cases in the IGB group, which starkly contrasts the lack of reported adverse events in the ESG cohort. In contrast, Fayad et al. observed a more balanced incidence of adverse events, with 1 of 41 patients in the ESG group and 1 of 47 in the IGB group experiencing complications. The details for adverse effects were provided only in Petriczko et al. patients with IGB placement experienced adverse events like nausea, vomiting, or abdominal pain, necessitating early device removal. Conversely, no adverse events were reported in the ESG group, and no deaths or serious incidents requiring surgery were reported.

Heterogeneity and Sensitivity Analysis

We excluded one study at a time to assess the possible dominant effect of individual studies on the meta-analysis and analyzed its effect on the main summary estimate. We did not find any single study that significantly affected the outcomes of interest or the heterogeneity. We have reported the I^2 % values for all pooled outcomes studied in Supplementary Table 2 alongside the pooled rates.

Discussion

Our systematic review and meta-analysis focused on assessing the effectiveness of ESG compared to IGB in treating refractory obesity. The results reveal a notable preference for ESG in achieving a greater percentage of total body weight loss (%TBWL) at both 6 and 12 months post-procedure, coupled with fewer adverse events.

The trend towards ESG's efficacy aligns with previous studies. For example, Petriczko et al. reported similar outcomes with the mean TBWL in patients undergoing IGB placement for 6 and 12 months, and ESG after 6 and 12 months were 15.2, 15.8, 26.5, and 28.7 kg, respectively. This consistency across different research designs strengthens the validity of our results, underlining ESG's potential benefits over IGB. However, the lack of RCTs in the final study set weakens the overall impact of the result. Furthermore, the majority of studies included are retrospective, which may introduce biases, and the limited reporting of adverse events in these studies calls for a cautious interpretation of the safety profile. Despite a comprehensive approach adhering to PRISMA guidelines, our study's limitations include heterogeneity in study designs and populations, possibly impacting the generalizability of the findings.

In conclusion, this meta-analysis provides evidence supporting the use of ESG over IGB for obesity management, highlighting its superior weight loss outcomes and potentially safer profile. Future prospective studies are needed to validate these minimally invasive treatments' long-term effectiveness and safety.

Abbreviations

ESG: Endoscopic Sleeve Gastroplasty; IGB: Intragastric Balloon; Total Body Weight Loss

Disclosures : No financial disclosures

Conflicts of Interest

All authors declare no conflicts of interest.

Ethics Statement

This is a meta-analysis of already published studies/ data; therefore, it does not involve active human participants and/ or animals. Hence, formal consent, informed consent, institutional

review board approval, and ethics approval are not applicable and/ or not required.

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