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REVIEW

Does Bariatric Surgery Improve Lymphedema? A Scoping Review

Jorge Urbina[1,2] · **Benjamin Clapp**[3]

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Abstract

Obesity is a recognized risk factor for lymphatic dysfunction and lymphedema, yet the burden of lymphatic disease among populations undergoing Metabolic Bariatric Surgery (MBS) and the impact of MBS on established lymphedema remain unclear. We conducted a scoping review in accordance with PRISMA-ScR guidelines, searching PubMed, ClinicalKey, and the Cochrane Library for studies evaluating lymphatic disease in bariatric populations or reporting lymphedema-related outcomes following MBS. Six studies met the inclusion criteria, consisting primarily of case reports and small case series. MBS was variably associated with reductions in limb volume and symptom burden; however, objective physiologic assessments frequently demonstrated persistent lymphatic dysfunction despite substantial weight loss. Current evidence suggests MBS may provide clinical improvement in selected patients but should be considered an adjunct rather than a definitive treatment for lymphedema, highlighting the need for prospective studies with standardized outcomes.

Key Points

- Obesity is associated with lymphatic dysfunction and risk of lymphedema.
- Limited evidence suggests metabolic bariatric surgery may complement lymphedema-directed care.
- Metabolic bariatric surgery may improve symptoms despite persistent lymphatic dysfunction.
- Standardized physiologic measures are needed to guide future bariatric research.

Introduction

Lymphedema is a chronic, progressive condition characterized by impaired lymphatic transport, leading to interstitial fluid accumulation and inflammation, and can eventually progress to tissue fibrosis [1]. Clinically, it is associated with recurrent infections, functional impairment, and substantial reductions in quality of life. It is traditionally associated with congenital abnormalities or secondary injury following oncologic treatment. Lymphedema has been increasingly recognized as a metabolic and inflammatory disease influenced by systemic factors, particularly obesity. [2–3].

A growing body of experimental and clinical evidence demonstrates that obesity adversely affects lymphatic structure and function through multiple mechanisms [4]. Animals and human studies have shown that excess adiposity is associated with reduced lymphatic pumping capacity, lymphatic vessel dilation, valvular dysfunction, chronic inflammation, and impaired immune cell trafficking [5]. These changes compromise lymphatic transport and promote the accumulation of interstitial fluid. At the same time, lymphatic dysfunction contributes to a self-perpetuating cycle of adipose accumulation, fibrosis, and persistent inflammation, accelerating disease progression [6]. Clinically, patients with obesity are more likely to present with advanced-stage lymphedema, demonstrate poorer response to conservative therapy, and are more likely to experience worse functional outcomes compared with non-obese individuals [7].

Recent epidemiologic data further underscore the burden of lymphatic disease in the population undergoing Metabolic Bariatric Surgery (MBS). The LIMPRINT (Lymphedema IMpact and PRevalence INTernational) study, which assessed patients undergoing MBS, reported that more than 50% of individuals had chronic edema, most commonly

✉ Benjamin Clapp
bclappmd@gmail.com

Jorge Urbina
jorge.urbina@edu.uag.mx

[1] Department of Surgery, Mayo Clinic, Jacksonville, USA

[2] Universidad Autónoma de Guadalajara, Guadalajara, Mexico

[3] El Paso Bariatric Surgery, El Paso, USA

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early-stage disease [8]. These findings suggest that lymphatic dysfunction is highly prevalent and frequently underrecognized among patients with severe obesity. Given this strong association, weight reduction has been proposed as a potential therapeutic strategy for lymphedema, particularly in obesity-associated disease. MBS remains the most effective and durable intervention for achieving significant weight loss in patients with severe obesity and has been shown to improve numerous obesity-related comorbidities [9, 10]. However, whether MBS leads to meaningful improvement or significant resolution of established lymphedema remains uncertain.

The existing literature addressing lymphedema outcomes after MBS is limited and heterogeneous, consisting primarily of case reports and small case series, with variable lymphedema phenotypes, surgical approaches, and outcome measures. Some studies report reductions in limb volume, symptom burden, functional status, and physiologic assessment of lymphatic function, as well as increased use of combined bariatric and lymphedema-directed surgical approaches [11–13]. However, the nature of this evidence, the absence of randomized or comparative studies, and variability in outcome definitions limit the ability to draw definitive conclusions regarding the effects of MBS on established lymphatic disease. In this context, a scoping review is well-suited to mapping the available literature, contextualizing reported findings, and identifying key knowledge gaps. Accordingly, the objective of this review is to synthesize existing evidence on the prevalence of lymphatic disease in bariatric patients and to determine outcomes following MBS, with particular attention to distinctions between clinical manifestations and physiologic lymphatic function, and the role of adjunctive lymphedema-directed interventions.

Methods

Study Design

We conducted a scoping review in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines [14]. A scoping review methodology was selected because the existing literature is limited, heterogeneous, and predominantly case-based, making it better suited to mapping available evidence and identifying knowledge gaps.

Search Strategy

We conducted a comprehensive literature search in PubMed (MEDLINE), ClinicalKey, and the Cochrane Library from database inception to the present. Our search strategy combined terms related to lymphedema, chronic edema, and massive localized lymphedema with terms pertaining to metabolic bariatric surgery and weight-loss procedures. Our search strategy was the following: ((lymphedema OR lymphoedema OR “obesity-induced lymphedema” OR “obesity induced lymphedema”) AND (bariatric OR “sleeve gastrectomy” OR “gastric bypass” OR “Roux-en-Y”)) NOT (chylous OR chyle OR “lymphatic leak” OR leakage OR lipedema OR lipoedema). Search strategies were adapted as appropriate for each database. Search results were limited to human studies and English-language publications. No restrictions were placed on study design or publication date.

Study Selection

We imported all retrieved records into Zotero for reference management and duplicate removal and subsequently uploaded them to Rayyan for title and abstract screening. Our primary outcome was the description of postoperative lymphedema outcomes, including clinical improvement, changes in limb volume, functional outcomes, and objective physiologic measures. Our inclusion criteria were as follows: (1) articles that reported postoperative lymphedema-related outcomes following MBS in adult patients, and (2) articles that reported the prevalence or baseline burden of chronic edema or lymphedema in the bariatric population, included to provide epidemiologic context. We acknowledge that chronic edema and lymphedema are distinct clinical entities and are not always equivalent; studies reporting chronic edema outcomes are included where relevant to the scoping objectives, but are discussed separately from studies specifically addressing lymphedema diagnosis and outcomes. Our exclusion criteria were articles that focused exclusively on postoperative lymphatic complications (e.g., chylous leak), addressed lipedema without lymphedema, reported only pathophysiology or risk factors without a clinical context, or did not include MBS as an intervention or population of interest. Discrepancies in eligibility were resolved through discussion among the authors.

Search Results

Our initial search yielded 179 records from PubMed, 26 from ClinicalKey, and 8 from the Cochrane Library, for a total of 213 records before duplicate removal. After screening and full-text review, six studies met the inclusion criteria and were included in the final scoping review. Newman et al. (LIMPRINT), which did not report postoperative outcomes, was excluded from the formal evidence synthesis and is cited in the Introduction as epidemiologic background. The PRISMA flow diagram provides a more transparent account of the selection process (Fig. 1).

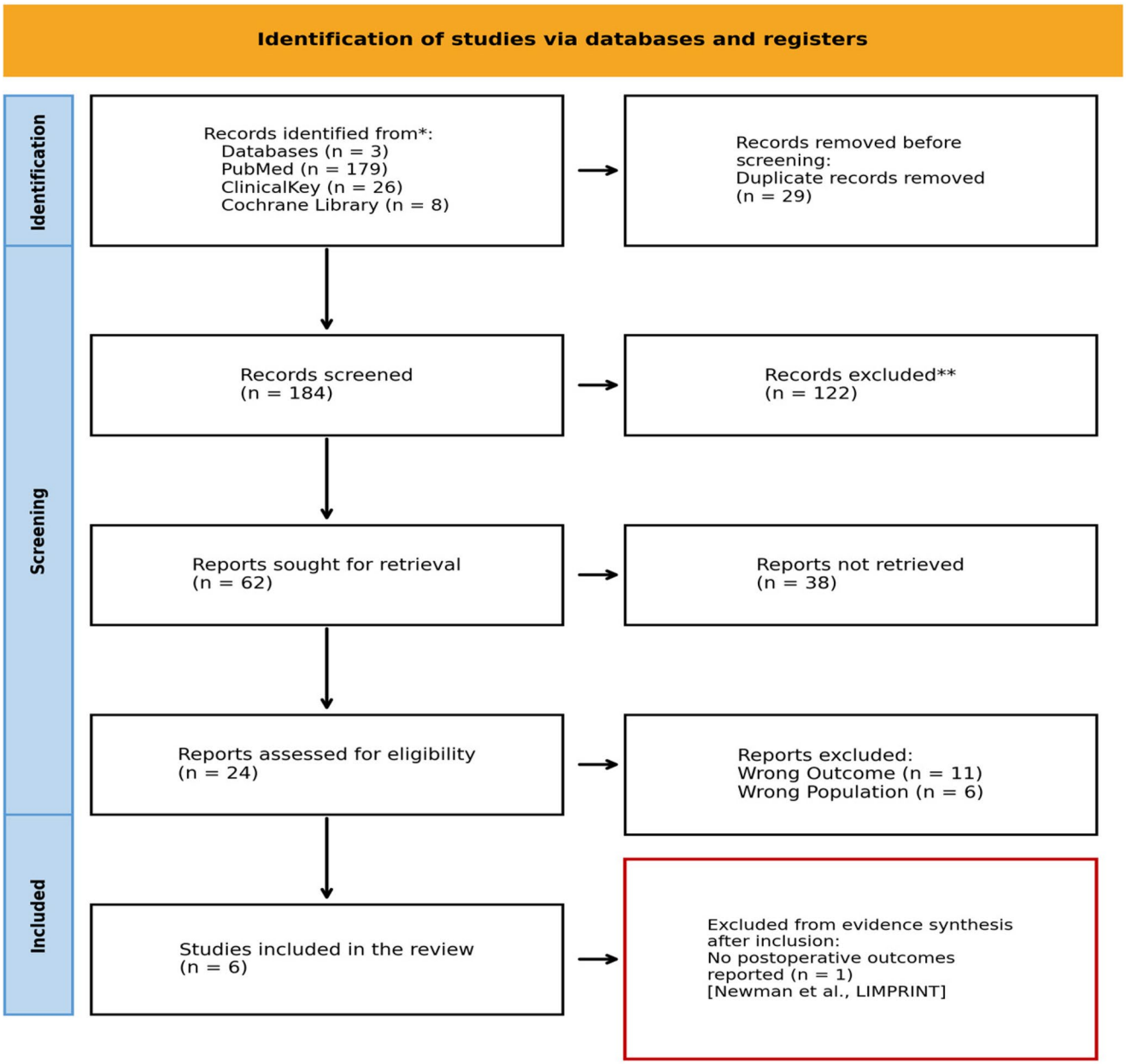

Fig. 1 PRISMA flow diagram of study selection

Data Extraction

Title and abstract screening was performed independently and in duplicate by two reviewers using Rayyan; discrepancies were resolved through discussion among all authors. Data extraction was likewise performed independently and in duplicate by two reviewers using a standardized form; any discrepancies were resolved through consensus discussion. Extracted variables included: study design and year of publication; number of patients; lymphedema phenotype (obesity-induced, secondary, massive localized); bariatric procedure performed; use of adjunctive lymphedema-directed therapies; and reported outcomes, including limb volume changes, symptom improvement, physiologic measures, and follow-up duration. The structured visualization is shown in Table 1.

Data Synthesis

We synthesized the results narratively and organized them by study focus: the prevalence of lymphatic disease in bariatric populations; MBS as a standalone intervention; combined bariatric and lymphedema-directed surgical approaches; and outcomes in massive localized

Table 1 Baseline Characteristics of included articles

Author (Year)	Study Design	Lymphedema Type	Bariatric Intervention	Adjunct Lymphedema Treatment	Key Outcomes
Greene et al. (2015) [12]	Prospective case report	Obesity-induced lower limb LE	Sleeve gastrectomy	Conservative therapy	BMI ↓ 80→36; no improvement in lymphoscintigraphy despite massive weight loss
Pereira de Godoy et al. (2019) [15]	Case report	Lower limb LE (stage II)	Bariatric surgery (type not specified)	Compression/CDT	Clinical improvement to stage 0; persistent abnormal bioimpedance
Hendrickx et al. (2022) [11]	Multiple case report ($n=9$)	Primary, secondary, and obesity-induced LE	Bariatric surgery (mixed)	Not uniformly specified	Significant reductions in leg volumes and BMI at the group level
Hou et al. (2019) [16]	Case report	Massive localized lymphedema (MLL)	Sleeve gastrectomy	Concurrent MLL resection	Functional improvement, improved mobility
Sim et al. (2025) [13]	Case report	Secondary LE (ISL grade 3)	Sleeve gastrectomy	VLNT+LVA+liposuction	36% limb volume reduction at 4 months; no recurrent cellulitis
Welling et al. (2022) [17]	Case report	Genital/MLL variant	Bariatric context	Surgical excision	Symptomatic improvement

LE lymphedema, *MLL* massive localized lymphedema *BMI* body mass index, *CDT* complete decongestive therapy, *VLNT* vascularized lymph node transfer, *LVA* lymphovenular anastomosis

lymphedema. Due to heterogeneity in study design and outcome reporting, quantitative synthesis or meta-analysis was not performed.

Results

Study Characteristics

The six included studies reporting postoperative lymphedema outcomes were published between 2015 and 2025 and consisted primarily of case-based evidence, including one multiple case series and five single-patient case reports. Sample sizes ranged from one to nine patients.

Lymphedema phenotypes included obesity-induced lymphedema, secondary lymphedema following oncologic treatment, and massive localized lymphedema (MLL). Bariatric interventions primarily included sleeve gastrectomy, with some studies reporting mixed or unspecified bariatric procedures. Outcome measures were heterogeneous and included clinical staging, limb volume measurements, functional outcomes, and physiologic assessments such as lymphoscintigraphy and bioimpedance analysis.

Prevalence of Chronic Edema in the Bariatric Population

The six included studies are organized by study focus: MBS as a standalone intervention, combined bariatric and lymphedema-directed surgical approaches, and outcomes in massive localized lymphedema. Newman et al. (LIMPRINT) was not included in the formal evidence synthesis because it did not report postoperative lymphedema outcomes; its findings are discussed in the Introduction as epidemiologic context for disease prevalence in the bariatric population [8].

Metabolic Bariatric Surgery as a Standalone Intervention

Three studies reported outcomes following MBS without concurrent lymphedema-directed surgical intervention. Evidence regarding MBS as a standalone intervention consisted of limited case-based reports with heterogeneous outcome measures.

In a multicenter case series of 9 patients with end-stage primary, secondary, and obesity-induced lymphedema [11], Hendrickx et al. reported quantitative decreases in body weight, body mass index, and lower-limb volumes following MBS. Group-level data showed postoperative decreases in weight, BMI, and lower-limb volumes in most patients;

however, given the small size ($n = 9$) and variable follow-up duration, these observations should be interpreted as preliminary signs rather than established patterns.

In contrast, Greene et al. reported a prospective physiologic case study of obesity-induced lower-extremity lymphedema in which MBS resulted in substantial weight loss, with body mass index decreasing from approximately 80 kg/m² preoperatively to 36 kg/m² postoperatively. Despite this marked reduction in body weight, lymphoscintigraphy performed before and after weight loss demonstrated persistent abnormalities in lymphatic transport, indicating no physiologic normalization of lymphatic function [2].

Another case report, Pereira de Godoy et al., described clinical improvement in lymphedema staging following MBS; however, bioimpedance analysis remained abnormal years after weight loss, indicating discordance between clinical and physiologic outcomes [15].

Metabolic Bariatric Surgery Combined with Lymphedema-Directed Procedures

Two studies reported outcomes following combined MBS and lymphedema-directed surgical interventions, although the surgical strategies and target pathologies differed. A 2025 case report detailed a one-stage operative strategy combining sleeve gastrectomy with vascularized lymph node transfer, lymphovenular anastomosis, and liposuction [13]. Sim et al. reported a single-patient case of a one-stage operative approach combining sleeve gastrectomy with vascularized lymph node transfer, lymphovenular anastomosis, and liposuction for secondary lower-extremity lymphedema. At four months of follow-up, the patient demonstrated a 36% reduction in limb volume and resolution of recurrent cellulitis episodes.

Management of Massive Localized Lymphedema

Two case reports focused on patients with MLL, in which MBS was performed concurrently with surgical resection or debulking of lymphedematous tissue [16, 17]. Hou et al. described a case of thigh MLL managed with concurrent sleeve gastrectomy and surgical resection of lymphedematous tissue. Postoperatively, the patient experienced improved mobility, functional status, and quality of life, with no major perioperative complications reported. Because MBS and debulking were performed simultaneously, the independent contribution of weight loss to improvement in lymphedema could not be isolated [16].

Similarly, Welling et al. reported a case of massive scrotal lymphedema in a bariatric patient treated with surgical excision of lymphedematous tissue in the context of severe obesity [17]. Postoperatively, the patient demonstrated marked symptomatic relief, improved hygiene, and enhanced functional capacity. These studies consistently reported improvements in mobility, hygiene, and functional status following surgery. However, because bariatric and debulking procedures were performed concurrently, the independent contribution of weight loss to improvement in lymphedema could not be isolated.

Discussion

Our scoping review mapped the existing literature on the relationship between MBS and lymphedema, with particular attention to baseline lymphatic disease burden in bariatric populations and to reported postoperative lymphedema-related outcomes. Across six included studies totaling 14 patients with postoperative outcome data, the available evidence remains limited, heterogeneous, and entirely case-based. This evidence base is insufficient to inform clinical practice in any direction. The primary output of this review is the identification of the research gaps that must be addressed before any conclusions about treatment effect can be drawn. Collectively, the available reports offer only preliminary, hypothesis-generating observations; no inference about whether MBS provides a clinically meaningful or physiologically durable benefit for lymphedema can be supported by this literature.

The inclusion of the LIMPRINT study provides essential context for interpreting postoperative outcomes. Newman et al. demonstrated that more than half of patients undergoing MBS assessment had chronic edema, most commonly early-stage disease. This high prevalence underscores that lymphatic dysfunction is common and frequently underrecognized among individuals with severe obesity. Importantly, the LIMPRINT study did not assess postoperative outcomes, highlighting a critical gap between the documented burden of disease and the limited evidence addressing how MBS influences lymphatic function over time. This disconnect emphasizes the need to contextualize postoperative observations within a population already at high baseline risk for lymphatic impairment.

Evidence describing MBS as a standalone intervention for lymphedema remains sparse and inconsistent. Case-based reports demonstrate that substantial weight loss following MBS may be associated with reductions in limb volume, body mass index, and symptom burden in some patients [11, 15]. However, these findings are not uniform, and individual responses vary widely. The heterogeneity of reported outcomes likely reflects differences in lymphedema etiology, stage, chronicity, and assessment methods, as well as variability in bariatric procedures and follow-up duration [2]. Importantly,

the predominance of case reports and small case series limits the ability to generalize these observations or to determine which patients are most likely to benefit from weight loss alone [2, 11].

A key finding across the literature mapped in our scoping review is the discordance between clinical improvement and objective measures of lymphatic function. Studies employing lymphoscintigraphy or bioimpedance analysis consistently demonstrated persistent physiologic abnormalities despite reported improvements in clinical staging or symptom burden following MBS. These observations suggest that reductions in limb volume or symptom severity may reflect decreased lymphatic load, reduced inflammation, or improved venous return rather than true restoration of lymphatic transport capacity. From a clinical perspective, this distinction is important when counseling patients, as symptomatic improvement does not necessarily equate to reversal of underlying lymphatic dysfunction.

More recent reports describe combined surgical strategies that address both systemic obesity and local lymphatic pathology. These approaches include physiologic lymphatic reconstruction techniques, such as vascularized lymph node transfer and lymphovenular anastomosis, as well as debulking procedures for massive localized lymphedema [13, 16, 17]. Early outcomes from isolated cases suggest potential benefit, particularly in limb volume reduction, functional improvement, and reduced infectious complications [13]. However, the available evidence remains limited to single-patient reports; when MBS and lymphedema-directed procedures are performed concurrently, it is not possible to isolate the independent contribution of weight loss to observed improvements [16, 17]. These findings highlight the complexity of interpreting outcomes in multimodal surgical management.

Conservative medical management remains the cornerstone of lymphedema treatment and includes complete decongestive therapy, compression garments, manual lymphatic drainage, skin care, and exercise-based interventions [18]. These approaches are aimed at reducing limb volume, controlling symptoms, preventing disease progression, and minimizing complications such as cellulitis, but they do not restore normal lymphatic anatomy or transport capacity [19]. In patients with obesity-associated lymphedema, the effectiveness of conservative therapy may be limited by body habitus, reduced mobility, and challenges with long-term adherence. As a result, MBS has been proposed as a complementary strategy to reduce mechanical and inflammatory burden in selected patients, rather than as a replacement for established medical therapy.

Our scoping review highlights several essential gaps in the current literature. First, there is a complete absence of prospective or comparative studies evaluating lymphedema outcomes following MBS. Second, no study to date has used standardized, validated lymphedema outcome measures, making cross-study comparison impossible. Third, predictors of reversibility, such as disease stage, duration, and lymphedema phenotype, remain undefined. To meaningfully advance this field, future studies should meet minimum methodological requirements: prospective design with a defined comparator group; standardized lymphedema outcome definitions; objective physiologic assessment at baseline and at prespecified follow-up intervals; and enrollment of sufficient sample sizes to detect a clinically meaningful difference in limb volume or physiologic function.

Limitations

The findings of our scoping review should be interpreted in light of several limitations. The available evidence is predominantly case-based, with small sample sizes and substantial heterogeneity in patient populations, interventions, and outcome measures. The search was restricted to English-language publications across three electronic databases; grey literature, conference proceedings, and non-English sources were not searched, which may limit the comprehensiveness of evidence capture and introduce publication bias. Objective assessments of lymphatic function were inconsistently reported across studies. As a scoping review, this study did not aim to assess the quality of evidence or conduct a quantitative synthesis; therefore, conclusions regarding efficacy should be drawn cautiously.

Conclusions

In summary, the current evidence based on 14 patients across heterogeneous case reports is insufficient to support any conclusion about the efficacy of MBS for lymphedema. No inference about the treatment effect can be drawn from this literature. MBS may serve as a complementary adjunct to lymphedema-directed care in selected patients, but this hypothesis remains unproven. The primary contribution of this review is a precise characterization of what is not yet known and a framework for the research required to answer that question. The high prevalence of chronic edema among bariatric populations and the limited postoperative outcome data highlight a critical need for further prospective investigation to clarify the role of MBS in the prevention and management of lymphedema, which warrants a systematic investigation.

Authors' contributions J.U. oversaw the study and manuscript development, extracted the baseline characteristics data, wrote the introduction, results, discussion, and conclusion, and contributed the methods and data extraction. B.C conceptualization of the study, study design, performed methods, and data extraction, provided senior supervision, and made methodological and discussion revisions.

Data Availability No datasets were generated or analysed during the current study.

Declarations

Ethics Statement This article does not contain any studies with human participants or animals performed by any of the authors. For this type of study, formal consent is not required.

Conflict of Interest The authors declare no conflict of interest.

Competing interests B.C. is a consultant and proctor for Intuitive Surgical. Consultant for Medtronic and Endolumik. Speaker for Medtronic. Board of Directors for the American Society of Metabolic and Bariatric Surgeons. J.U. has no competing interests.

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