

MedPeer Publisher

Abbreviated Key Title: MedPeer

ISSN : 3066-2737

homepage: <https://www.medpeerpublishers.com>

Interrupting Glucagon-Like Peptide-1 Receptor Agonists or Individualizing the Full-Stomach Risk Before Elective Anesthesia: A Narrative Review of the 2023-2026 Evidence

DOI: 10.70780/medpeer.000QGXJ

AUTHOR AND AFFILIATION

Ahmed FAKRI¹, Maha SEKKAL¹, Mourad ABABOU¹, Marouane JIDAL¹, Youssef HALHOUL¹, Mustapha BENSGHIR¹

¹ Anesthesiology and Critical Care, Mohammed V Military Training Hospital, Rabat, MAR
Corresponding author: AHMED FAKRI

ABSTRACT

Glucagon-like peptide-1 receptor agonists (GLP-1 RAs), including the dual agonist tirzepatide, slow gastric emptying, and their growing use has raised concern about residual gastric content and pulmonary aspiration during anesthesia and procedural sedation. Recommendations have shifted since 2023 from routine interruption toward continued treatment with individualized risk assessment. We conducted a narrative review based on a systematic search of PubMed and Scopus for studies published from 2023 to October 2026 and synthesized 106 studies, including one randomized trial, 14 prospective studies and 20 systematic reviews, across five themes. GLP-1 RAs delay solid gastric emptying by approximately 36 to 74 minutes, with only partial tachyphylaxis. Despite standard fasting, residual gastric content is consistently more frequent in users, with pooled odds ratios of 3.95 to 6.30 at endoscopy and a full stomach in 40% to 56% of users on preoperative gastric ultrasound. Large databases and meta-analyses show no increase in coded pulmonary aspiration (pooled odds ratio close to 1.0), whereas studies based on direct reporting by anesthesiologists found an approximately tenfold higher incidence of regurgitation or aspiration (1.41% vs. 0.12% in a national prospective cohort, in which about half of the events occurred at emergence). Withholding one dose reduced clinically significant residual content from 25.0% to 3.1% in the only randomized trial, but interruptions of seven to 10 days still left a full stomach in 40% to 49% of patients in prospective ultrasound studies, whereas no residual content occurred in either trial arm among patients who had followed a clear-liquid diet the day before. Routine interruption is therefore neither reliably effective nor necessary for most patients. We propose an individualized strategy: continue treatment, prescribe a 24-hour clear-liquid diet, screen for high-risk features, use gastric ultrasound when doubt persists, and apply full-stomach precautions through emergence when risk remains. The certainty of the evidence is low, and trials under general anesthesia are needed.

KEYWORDS

GLP-1 receptor agonists, semaglutide, tirzepatide, pulmonary aspiration, residual gastric content, gastric ultrasound, preoperative fasting, procedural sedation

MAIN ARTICLE

INTRODUCTION AND BACKGROUND

Glucagon-like peptide-1 receptor agonists (GLP-1 RAs), such as semaglutide, liraglutide and dulaglutide, and the dual glucose-dependent insulinotropic polypeptide (GIP) and GLP-1 receptor agonist tirzepatide are now widely prescribed for type 2 diabetes and obesity. Their use among surgical patients has risen accordingly. In a national prospective study conducted in 119 hospitals in the United Kingdom (UK) in 2025, 1,348 of 47,039 adults receiving anesthesia care (2.9%, or one in 36) were taking one of these drugs, most often tirzepatide [1]. In an orthopedic cohort in the United States, the yearly prevalence of use rose from 0.4% to 2.9% between 2019 and 2024 [2].

These drugs slow gastric emptying, an effect that contributes to their glycemic and satiety benefits [3-5]. In 2023, a volunteer study found solid gastric content on ultrasound in 70% of fasted participants who had recently started semaglutide, compared with 10% of controls [6], and a retrospective study found residual gastric content during upper endoscopy in 24.2% of semaglutide users versus 5.1% of non-users [7]. Together with case reports of aspiration despite fasting, these findings led the American Society of Anesthesiologists (ASA) to advise withholding daily agents on the day of the procedure and weekly agents for one week beforehand [8].

Guidance has since moved in another direction. From 2024 onward, a multisociety statement [9], followed by British, American perioperative, Australian and New Zealand, Italian, Korean and European documents [10-15], favored continuing treatment with individualized risk assessment. Meanwhile, the evidence has grown rapidly and appears contradictory: residual gastric content is consistently more frequent in users, whereas large databases show no increase in pulmonary aspiration. Seventy-eight of the 106 studies included in this review were published in 2025 or 2026. Twenty systematic or scoping reviews already exist, including one in this journal [16], but most predate the first randomized trial of drug interruption [17] and the first national prospective cohort with direct reporting of aspiration events [1].

This narrative review, based on a systematic literature search, synthesizes the 2023-2026 evidence on five questions: how GLP-1 RAs affect gastric emptying; how often residual gastric content persists despite fasting; whether pulmonary aspiration and other clinical outcomes are increased; whether interrupting treatment empties the stomach; and what current guidelines recommend. We then propose a pragmatic algorithm to individualize the full-stomach risk.

REVIEW

Methods

Design and reporting. This narrative review is based on a systematic literature search. It was prepared according to the Scale for the Assessment of Narrative Review Articles (SANRA) [18], and study selection is reported in a flow diagram adapted from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement [19].

Search strategy. PubMed and Scopus were searched on October 6, 2026, for records published from 2023 to 2026. The PubMed query was (semaglutide OR liraglutide OR tirzepatide OR GLP-1) AND (anesthesia OR perioperative OR endoscopy) AND (aspiration OR gastric); an equivalent query was applied to titles, abstracts and keywords in Scopus. The reference lists of included reviews and guidelines were also screened. The full search strings are given in Appendix 1.

Eligibility criteria. We included studies of adults exposed to a GLP-1 RA or tirzepatide that reported gastric emptying, residual gastric content after fasting, regurgitation, pulmonary aspiration or other pulmonary complications during elective surgery, endoscopy or procedural sedation, the effect of interruption or fasting strategies, or recommendations. Eligible designs were randomized trials, cohort, case-control and cross-sectional studies, case series, systematic and scoping reviews, and guidelines published in English or French. We excluded narrative reviews and opinion articles, case reports, letters without original data, conference abstracts without a full publication, studies limited to non-elective surgery, and reports for which neither an abstract nor the full text was accessible.

Study selection and data extraction. Records were deduplicated in Zotero (Corporation for Digital Scholarship, Vienna, VA, USA). One author screened titles and abstracts and then assessed the reports. Data were extracted into a standardized 30-item form covering design, country, population, sample size, agent, procedure, type of anesthesia, interruption interval, fasting, assessment method, outcomes and main results. Data were extracted from the full text when it was accessible ($n = 53$) and otherwise from the published abstract ($n = 50$, including one conference abstract) or, for research letters without an abstract, from their supplementary material and the tables of published reviews ($n = 3$). An artificial intelligence assistant (Claude, Anthropic, San Francisco, CA, USA) supported the second screening pass, pre-filled the extraction form and drafted the manuscript and figures; the authors verified every included record and extracted value against the source documents.

Appraisal and synthesis. Each study was classified by design as a randomized trial, systematic review, prospective study, retrospective or database study, uncontrolled series or guideline. Because about half of the extraction relied on abstracts, no formal risk-of-bias tool was applied. Given heterogeneous exposures and outcome definitions and the existence of several meta-analyses, findings were synthesized narratively by theme without new pooling.

Results of the search

The search identified 747 records (333 in PubMed and 414 in Scopus). After removal of 212 duplicates, 535 records were screened, and 403 were excluded on title and abstract. Of the 132 reports sought, two had neither an abstract nor an accessible full text. Of the 130 reports assessed, 28 were excluded, leaving 102 studies; citation searching added four, for a total of 106 included studies (Figure 1). These comprised 55 retrospective or database studies, 20 systematic reviews or meta-analyses, 14 prospective studies, eight uncontrolled series, eight guidelines or consensus statements and one randomized trial. Most were published in 2025 ($n = 38$) or 2026 ($n = 40$); 74 (70%) came from the United States and none from Africa. Fifty-six concerned endoscopy, 38 surgery or other procedures under anesthesia and seven both; five involved no procedure (two meta-analyses of gastric emptying and three studies of fasted participants). Appendix 2 lists the characteristics of all included studies.

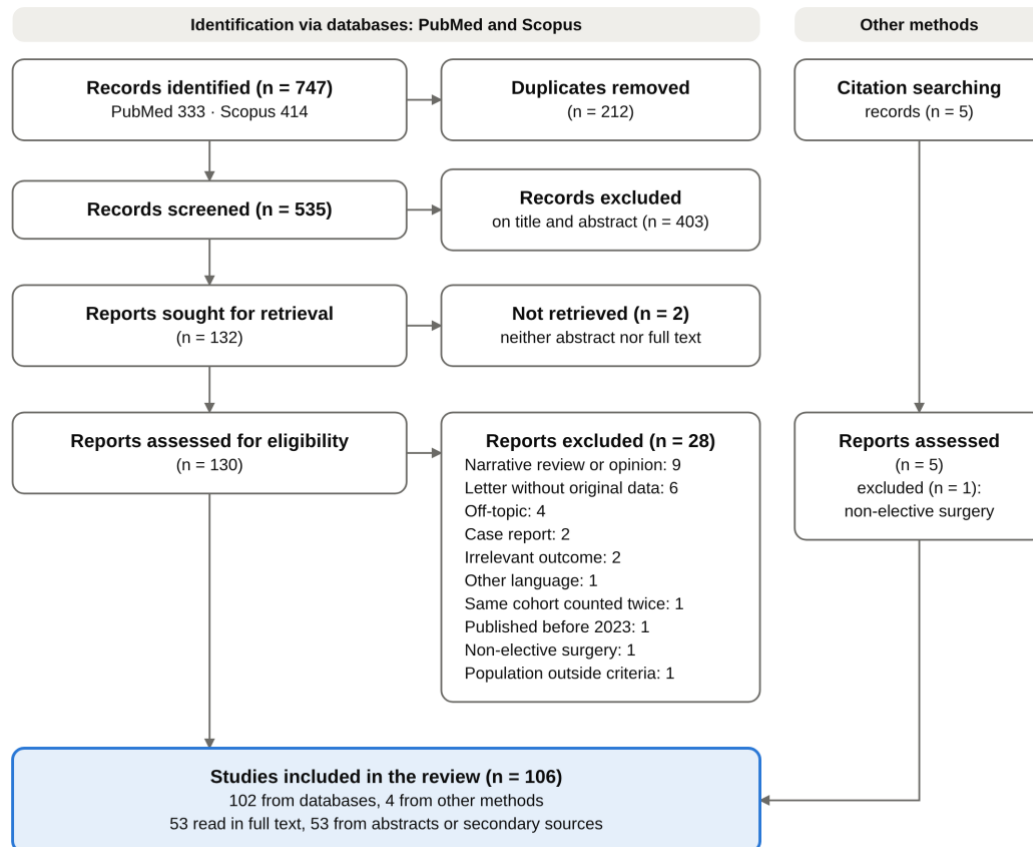


Figure 1: Flow diagram of study selection. Adapted from the PRISMA 2020 flow diagram [19], published under a Creative Commons Attribution (CC BY 4.0) license. Reports excluded after assessment: narrative review or opinion (n = 9), letter without original data (n = 6), off-topic (n = 4), case report (n = 2), irrelevant outcome (n = 2), other language (n = 1), same cohort counted twice (n = 1), published before 2023 (n = 1), non-elective surgery (n = 1) and population outside the criteria (n = 1). Citation searching identified five reports, of which one was excluded (emergency surgery).

Effect on gastric emptying

GLP-1 RAs slow gastric emptying, mainly of solids. In a meta-analysis of 15 studies, the gastric emptying half-time measured by scintigraphy (five studies) was 138.4 minutes with GLP-1 RAs versus 95.0 minutes with placebo, a delay of 36.0 minutes (95% confidence interval [CI] 17.0-55.0) with high heterogeneity; acetaminophen absorption, a marker of liquid emptying, showed no significant delay, and neither the agent, its duration of action nor treatment duration modified the effect [20]. A more recent meta-analysis restricted to prospective studies using reference methods (10 studies, 300 participants) found a larger

prolongation of 74 minutes (46-101), reaching 116 minutes with short-acting agents and 82 minutes during the first 10 weeks of treatment, with very low certainty [21].

Physiological studies showed that continuous GLP-1 receptor stimulation produces rapid tachyphylaxis of this effect [3,4], and the delay induced by tirzepatide was also transient [5]. Tachyphylaxis is, however, incomplete, as the delay persists during long-term treatment [20,21]. This pattern, with near-normal emptying of liquids but delayed emptying of solids, explains why solids dominate the residual content observed in clinical studies: they accounted for 78.9% of positive findings in a large endoscopic series [22] and 82% of positive ultrasound examinations in a prospective study [23].

Residual gastric content despite fasting

Endoscopic studies. Residual gastric content was more frequent in users in almost all endoscopic studies, typically 6% to 24% versus 1% to 6% in non-users [7,24-29]. Of 10 meta-analyses, nine reported pooled odds ratios (ORs) between 3.95 and 6.30 [30-38], or between 3.18 and 5.24 when restricted to adjusted estimates; one reported an unstable estimate of 15.39 [39]. The effect persisted in patients without diabetes (adjusted OR 5.66) [25] and against an active comparator, with inadequate mucosal visibility in 8.6% of GLP-1 RA users versus 1.4% of dipeptidyl peptidase-4 (DPP-4) inhibitor users (OR 6.14) [40]. Residual content also led to more aborted examinations, with pooled ORs of 3.9 to 5.5 [31,32,34,35,38].

Gastric ultrasound before anesthesia. Prospective studies using gastric point-of-care ultrasound (POCUS) found a full stomach, generally defined as solids, thick fluid or clear fluid above 1.5 mL/kg, in 40% to 56% of users despite standard fasting (Table 1) [23,41-44]. In surgical patients with diabetes, the median gastric volume was 0.61 versus 0.16 mL/kg, and the OR for a full stomach was 11.3 [45]. Three studies did not find a significant difference: one measured gastric volume after excluding patients with solids [46], one studied outpatients after 8 to 16 hours of fasting [47], and one, conducted after an interruption of at least seven days, was underpowered (42% vs. 24%) [23]. Two endoscopic studies were also negative [48,49].

Patients at higher risk. Residual content was more likely when the drug was prescribed for weight loss rather than diabetes (23% vs. 2.6%) [27], in patients with diabetic microvascular complications [44,50], with each 1% increase in glycated hemoglobin (HbA1c) (36% higher risk) [51], after recent opioid use [52], and with tirzepatide, which was associated with

residual content in 18.9% of users [38,53]. Each additional day since the last injection reduced the odds by 23% (OR 0.77) [44]. Gastrointestinal symptoms increased the risk (OR 15.1) [26], but their absence did not exclude it: in the randomized trial, no patient with residual content reported symptoms [17]. Confounders such as opioids, anticholinergic drugs and long-standing diabetes explained part of the association in one cohort [54].

Table 1: Prospective gastric ultrasound studies of residual gastric content in patients taking GLP-1 receptor agonists

Study	Population and timing	Users / controls, n	Full stomach, users vs. controls	Effect estimate (95% CI)	Data source
Sherwin et al., 2023 [6]	Volunteers recently started on semaglutide, 8-hour fast	10 / 10	Solids 70% vs. 10%	RR 3.50 (1.26-9.65)	Full text
Sen et al., 2024 [41]	Elective procedures, weekly agents	62 / 62	56% vs. 19%	Adjusted PR 2.48 (1.23-4.97)	Abstract
Nersessian et al., 2024 [42]	Elective surgery, patients without diabetes, last dose ≤10 days	107 / 113	40% vs. 3%	Weighted OR 36.97 (16.54-99.32)	Full text
Wolla et al., 2025 [45]	Elective surgery, patients with diabetes	106 / 100	Median volume 0.61 vs. 0.16 mL/kg	OR 11.3 (5.2-24.7)	Full text
Boudreau et al., 2026 [23]	Elective surgery after interruption ≥7 days	52 / 41	42% vs. 24%	Adjusted PR 1.65 (0.70-3.70)	Full text
Vlaeminck et al., 2026 [43]	Elective surgery, semaglutide, matched 1:1	44 / 44	49% vs. 18%	OR 4.29 (1.63-11.29)	Abstract

Study	Population and timing	Users / controls, n	Full stomach, users vs. controls	Effect estimate (95% CI)	Data source
Li et al., 2026 [44]	Inpatients with type 2 diabetes, overnight fast	224 / 166	53.3% vs. 32.1%	OR 2.52 (1.84-3.45)	Abstract
Oates et al., 2026 [46]	Elective surgery, median 9 days since last dose	60 / 57	No difference in gastric volume	Not applicable	Abstract
Shahidifar et al., 2026 [47]	Outpatients fasting 8-16 hours	74 / 60	Solids 5.4% vs. 5.0%	p = 0.56	Abstract

Full stomach was generally defined as solids, thick fluid or clear fluid >1.5 mL/kg. CI: confidence interval; GLP-1: glucagon-like peptide-1; OR: odds ratio; PR: prevalence ratio; RR: risk ratio.

Pulmonary aspiration and other clinical outcomes

Pooled and database evidence. Meta-analyses found no association between GLP-1 RA use and pulmonary aspiration: OR 1.04 (0.87-1.25) across nine studies, 185,414 patients and 471 events [36], and OR 1.11 (0.84-1.48) in endoscopy [32], with similar results in other meta-analyses [30,31,34,38,55] (Figure 2). A pooled analysis of database studies found a risk ratio (RR) of 1.00 in surgery and 1.10 in endoscopy, while the same approach detected the expected excess risk with opioids (RR 2.68), showing that these data can reveal a true signal [56]. Large surgical cohorts agreed: among 366,476 patients undergoing common procedures, aspiration pneumonia occurred in 0.7% of users versus 0.6% of non-users (adjusted OR 0.78, 0.57-1.06) [57], with similar findings in other claims databases [58-60] and against metformin, sodium-glucose cotransporter-2 (SGLT2) inhibitors and DPP-4 inhibitors as active comparators [61]. In endoscopy, a large matched cohort found no increase [62], nor did active-comparator studies, with RRs of 0.98 versus SGLT2 inhibitors [63] and 0.67 versus DPP-4 inhibitors [64].

Contrary signals. Some studies pointed the other way. In a matched cohort, users had a higher risk of aspiration pneumonia after endoscopy (hazard ratio [HR] 1.33, 1.02-1.74),

particularly with propofol sedation (HR 1.49) and upper endoscopy (HR 1.48), but not after colonoscopy alone [65]; a reanalysis using recent users as comparators found no increase [66]. A target trial emulation reported more respiratory complications after elective surgery (HR 1.61, 1.08-2.39) [67], and one meta-analysis, available to us only as an abstract, found an OR of 2.29 (1.36-3.87), possibly inflated by overlapping databases [33]. Conversely, large apparent protective effects (RR 0.31 and 0.67) [68,69] are best explained by healthy-user bias, as the authors of one of these studies acknowledge [69].

Direct reporting by anesthesiologists. The picture changes when events are recorded at the bedside. In the UK national prospective cohort, regurgitation or aspiration occurred in 19 of 1,348 users (1.41%, or one in 71) versus 57 of 45,691 non-users (0.12%) (OR 11.39, 6.47-20.05), and 53% of events in users occurred at emergence [1]. This estimate was not adjusted for obesity or diabetes. A single-center audit based on keyword searches of anesthesia records found a similar OR of 10.27 (2.94-35.82), with events at induction, after insertion of a supraglottic airway and at extubation [70]. Small series without controls reported no aspiration [71-73], but they lacked the power to detect a rare event.

Why the evidence diverges. Diagnostic codes capture rare, clinically significant aspiration pneumonitis and miss regurgitation managed in the operating room. A prescription does not prove recent intake, and many databases predate the 2023 recommendations and the widespread use of high-dose agents and tirzepatide, which accounted for 70% of exposure in the UK cohort [1]. Conversely, unadjusted confounding and heightened vigilance toward patients known to take GLP-1 RAs may inflate the prospective signal. Residual gastric content is therefore best viewed as a necessary but not sufficient condition for aspiration, which also requires a vulnerable airway moment.

Other outcomes. GLP-1 RA use was associated with more aborted endoscopies (RR 1.99) [63] and more postoperative nausea and vomiting (OR 1.22), but not with more difficult intubation (OR 1.02) [74]. GLP-1 RA use was also associated with lower perioperative glucose and less rescue insulin [37].

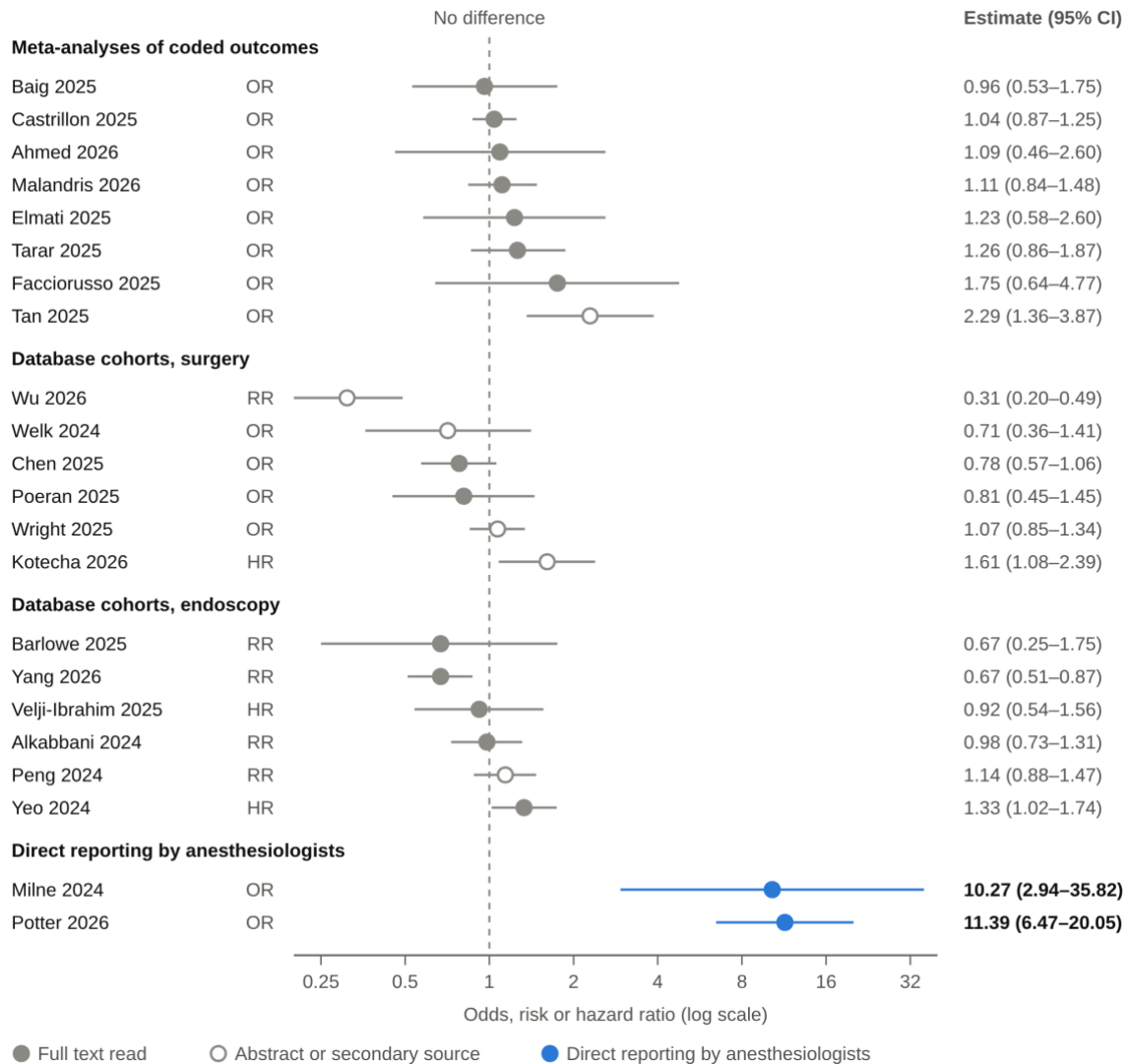


Figure 2: Reported estimates of pulmonary aspiration or related respiratory outcomes in patients taking GLP-1 receptor agonists, grouped by how events were ascertained.

Points show odds ratios, risk ratios or hazard ratios with 95% confidence intervals on a logarithmic scale; estimates were not pooled. Outcome definitions differ: coded aspiration pneumonitis or pneumonia in database studies, and regurgitation or aspiration reported by the anesthesiologist in the direct-reporting studies, whose estimates are unadjusted. Open symbols indicate data extracted from abstracts or secondary sources. CI: confidence interval; HR: hazard ratio; OR: odds ratio; RR: risk ratio.

Interruption of treatment

The randomized trial. The only randomized trial (OCULUS) allocated 68 patients on stable GLP-1 RA or tirzepatide therapy who were undergoing upper endoscopy under moderate sedation or monitored anesthesia care to withholding one dose or continuing treatment [17].

Clinically significant residual content occurred in 3.1% of patients after one withheld dose versus 25.0% with continuation (difference 21.9%, 90% CI 7.0-36.7), and the trial was stopped early. Among patients who followed a clear-liquid diet the day before because of a concomitant colonoscopy, the rate was 0% in both arms, whereas a solid meal the evening before increased the risk (OR 9.66). The trial analyzed only 60 patients, excluded higher-risk patients and did not include general anesthesia, and early stopping may have exaggerated the effect.

Duration of interruption. Observational data suggest that a one-week interruption is often insufficient (Table 2). Compared with non-users, the odds of residual content remained elevated after interruptions shorter than eight days (OR 10.0) and of eight to 14 days (OR 4.59), and only interruptions longer than 14 days without symptoms were no longer associated with residual content (OR 0.77) [26]. Prospective ultrasound studies found a full stomach in 40% to 49% of patients after skipping one dose or stopping for seven to 10 days [23,42,43], and a two-week interruption did not normalize the risk in patients with obesity [75]. Pooled data suggested that withholding at least one dose halved the odds of residual content (OR 0.51, 0.33-0.81), but this result was not robust to adjustment for publication bias [36]. Two prospective studies, one limited to patients with diabetes and one without an unexposed group, supported a seven-day threshold [45,52], and following the ASA rule was associated with less residual content in a retrospective study (4.4% vs. 12.7%) [51]. A direct comparison in bariatric patients showed a non-significant trend in the same direction (2.7% after interruption vs. 6.4% with continuation) [76].

Fasting duration and costs of interruption. The duration of the fast may matter more than the date of the last dose. Fasting from solids for more than 15 hours (adjusted OR 0.33) [77] or more than 21 hours [52] was associated with less residual content, whereas time since the last dose did not predict content in outpatients [47]. Interruption also has potential costs: GLP-1 RA use was associated with better perioperative glycemic control [37], although a before-and-after study found no short-term difference in glucose control when treatment was held [78], and interruption requires a shared decision with the prescriber that weighs metabolic risk [9].

Table 2: Studies of treatment interruption and dietary strategies

Study	Design, users (n)	Strategy compared	Residual gastric content	Data source
Ahmad et al., 2026 [17]	Randomized trial, 60	One dose withheld vs. continued	3.1% vs. 25.0%; 0% in both arms with clear liquids	Full text
Santos et al., 2024 [26]	Retrospective , 123	Bands of interruption duration	OR 10.0 (<8 days), 4.59 (8-14 days), 0.77 (>14 days, no symptoms)	Full text
Nersessian et al., 2024 [42]	Prospective ultrasound, 107	Interruption of 1-7 vs. 8-10 days	40% overall, raised in both groups	Full text
Boudreau et al., 2026 [23]	Prospective ultrasound, 52	Interruption ≥ 7 days (median 11)	42% vs. 24% in controls	Full text
Wolla et al., 2025 [45]	Prospective ultrasound, 106	<7 vs. 7-14 vs. >14 days	Larger volume only below 7 days	Full text
Dong et al., 2026 [75]	Retrospective , 165	Two-week interruption vs. continuation	1.61% vs. 5.83% (non-users 0.4%)	Abstract
Pai et al., 2026 [52]	Prospective ultrasound, 316	Interruption and solid-fast thresholds	35.8% overall; higher risk if interruption ≤ 7.5 days or solid fast ≤ 21.3 hours	Abstract
Mendez-Pino et al., 2026 [77]	Retrospective , 337	Solid fast >15 hours	Adjusted OR 0.33 (0.13-0.81)	Abstract
Wilson et al., 2026 [79]	Prospective, 256 patients	One-week interruption plus 24-hour clear liquids vs. 8-hour fast in controls	8% vs. 6%	Abstract
Ghazanfar et al., 2024 [80]	Retrospective , 306	Clear-liquid vs. normal diet the day before	1.5% vs. 10%	Full text

OR: odds ratio.

Guidelines and individualized strategies

Evolution of recommendations. Recommendations have moved from interruption toward continuation (Table 3). The 2023 ASA guidance advised withholding weekly agents for one week [8]. The 2024 multisociety guidance no longer recommended routine interruption, reserving it for high-risk patients, together with a liquid diet of at least 24 hours and gastric ultrasound in case of doubt [9]. Subsequent documents went further. The UK consensus recommends continuing treatment with usual fasting, considering gastric ultrasound before induction and using risk-reducing anesthetic techniques [10]. The Society for Perioperative Assessment and Quality Improvement (SPAQI) recommends 24 hours without solids and clear fluids until four hours before the procedure [11]. The Australian and New Zealand guidance recommends a 24-hour clear-liquid diet for all patients and states that no interruption interval can be recommended and that symptoms cannot stratify risk [12]. The Italian, Korean and European documents also favor continuation with individualized management [13-15].

The 24-hour clear-liquid diet. This is the most widely shared measure and the one with the most consistent supporting data. In the randomized trial, no residual content occurred in either arm among patients who followed a clear-liquid diet the day before [17]. After a one-week interruption combined with a 24-hour liquid diet, residual content was similar to that of controls (8% vs. 6%) [79], and a clear-liquid diet the day before was associated with less residual food (1.5% vs. 10%) [80]. Same-day colonoscopy, which imposes clear liquids and bowel preparation, was protective in more than 10 studies, with pooled ORs of 0.26 to 0.28 [31,35,38]. One case-control study found residual content despite colonoscopy preparation, but its design does not allow an incidence to be estimated [81].

Gastric ultrasound. Gastric POCUS allows individual assessment and can avoid unnecessary cancellations: in a pilot study, 20 of 25 patients who had taken semaglutide within the previous seven days had an empty stomach and underwent surgery as planned [82]. Regional anesthesia experts gave conditional support to its use in patients taking GLP-1 RAs [83]. Its limitations include obesity, inconclusive examinations and the need for training, and aspiration has occurred despite a gastric volume considered normal [45]. It remains rarely used: in 1.3% of users in the UK cohort and 3.4% in a single-center audit [1,84].

Table 3: Recommendations on GLP-1 receptor agonists before procedures, 2023-2026

Document	Year	Region	Interruption	Diet and fasting	Gastric ultrasound	Other measures
ASA guidance [8]	2023	United States	Day of procedure for daily agents, 1 week for weekly agents	Standard fasting	Consider if not interrupted	Full-stomach precautions
Kindel et al. (AGA, ASMBS, ASA, ISPCOP, SAGES) [9]	2024	United States	Not routine; possible if high risk	Liquids ≥ 24 hours if high risk	If in doubt on the day	Shared decision; rapid sequence or postponement
El-Boghdadly et al. (Association of Anaesthetists and partner societies) [10]	2025	United Kingdom	No: continue	Usual fasting	Consider before induction	Regional anesthesia; tracheal intubation; gastric tube; awake extubation
Oprea et al. (SPAQI) [11]	2025	United States	Continue if no significant symptoms	No solids for 24 hours; carbohydrate drinks until 8 hours; clear fluids until 4 hours	Not detailed	Symptomatic patients referred to the prescriber
Hocking et al. (ADS, ANZCA,	2025	Australia and	Continue; no interruption interval can	24-hour clear liquids, then	If the diet was not followed	Intravenous erythromycin; symptoms

Document	Year	Region	Interruption	Diet and fasting	Gastric ultrasound	Other measures
GESA, NACOS) [12]		New Zealand	be recommended	6-hour fast, for all		cannot stratify risk
Facciorusso et al. (SIGE) [13]	2026	Italy	Not routine before upper endoscopy	Liquid diet if long or complex procedure or symptoms	Not detailed	No additional measure for colonoscopy
Bang et al. (Korean Society of Anesthesiologists) [14]	2026	South Korea	Continue in most patients	24-hour clear liquids, then standard fasting	If symptoms or diet not followed; inconclusive is not empty	Prokinetic, gastric tube, rapid sequence, regional anesthesia
Haskins et al. (ASRA Pain Medicine) [83]	2026	United States	Not addressed	Not addressed	Conditional support in GLP-1 RA users	Complements clinical judgment
Triantafyllou et al. (ESGE, ESGENA) [15]	2026	Europe	Individualize	Not specified	Not specified	Individualized sedation (conditional)

ADS: Australian Diabetes Society; AGA: American Gastroenterological Association; ANZCA: Australian and New Zealand College of Anaesthetists; ASA: American Society of Anesthesiologists; ASMBS: American Society for Metabolic and Bariatric Surgery; ASRA: American Society of Regional Anesthesia and Pain Medicine; ESGE: European Society of Gastrointestinal Endoscopy; ESGENA: European Society of Gastroenterology and Endoscopy Nurses and Associates; GESA: Gastroenterological Society of Australia; GLP-1 RA: glucagon-like peptide-1 receptor agonist; ISPCOP: International Society of Perioperative Care of Patients with Obesity; NACOS: National Association of Clinical Obesity Services;

SAGES: Society of American Gastrointestinal and Endoscopic Surgeons; SIGE: Italian Society of Gastroenterology; SPAQI: Society for Perioperative Assessment and Quality Improvement.

Proposed algorithm

Figure 3 summarizes a pragmatic strategy derived from this evidence. First, every patient should be asked about GLP-1 RA or tirzepatide use, including the agent, dose, indication, date of the last injection, recent dose increases and gastrointestinal symptoms. Second, treatment should be continued by default, with a 24-hour clear-liquid diet followed by standard fasting; doses of insulin and sulfonylureas may need adjustment during the liquid day to avoid hypoglycemia. Third, patients with a high-risk feature, those who did not follow the diet and those in whom doubt persists should undergo gastric ultrasound before induction when it is available. High-risk features include the dose-escalation phase, a weight-loss indication, an injection within the previous three days, gastrointestinal symptoms, diabetic microangiopathy or high HbA1c, opioid use, obesity, tirzepatide, and upper endoscopy under propofol sedation [9,27,38,44,51,52,65,75,82]. Fourth, when the stomach is full or the examination is inconclusive, an elective procedure should be postponed. If it cannot wait, or if ultrasound is unavailable in a high-risk patient, full-stomach precautions apply: rapid sequence induction, a tracheal tube rather than a supraglottic airway, gastric decompression, awake extubation and close vigilance during emergence [1,10,14]. Interrupting the drug should be a last resort, considered with the prescriber when a liquid diet is impossible and ultrasound is unavailable in a high-risk patient, knowing that a one-week interruption may not empty the stomach [23,26].

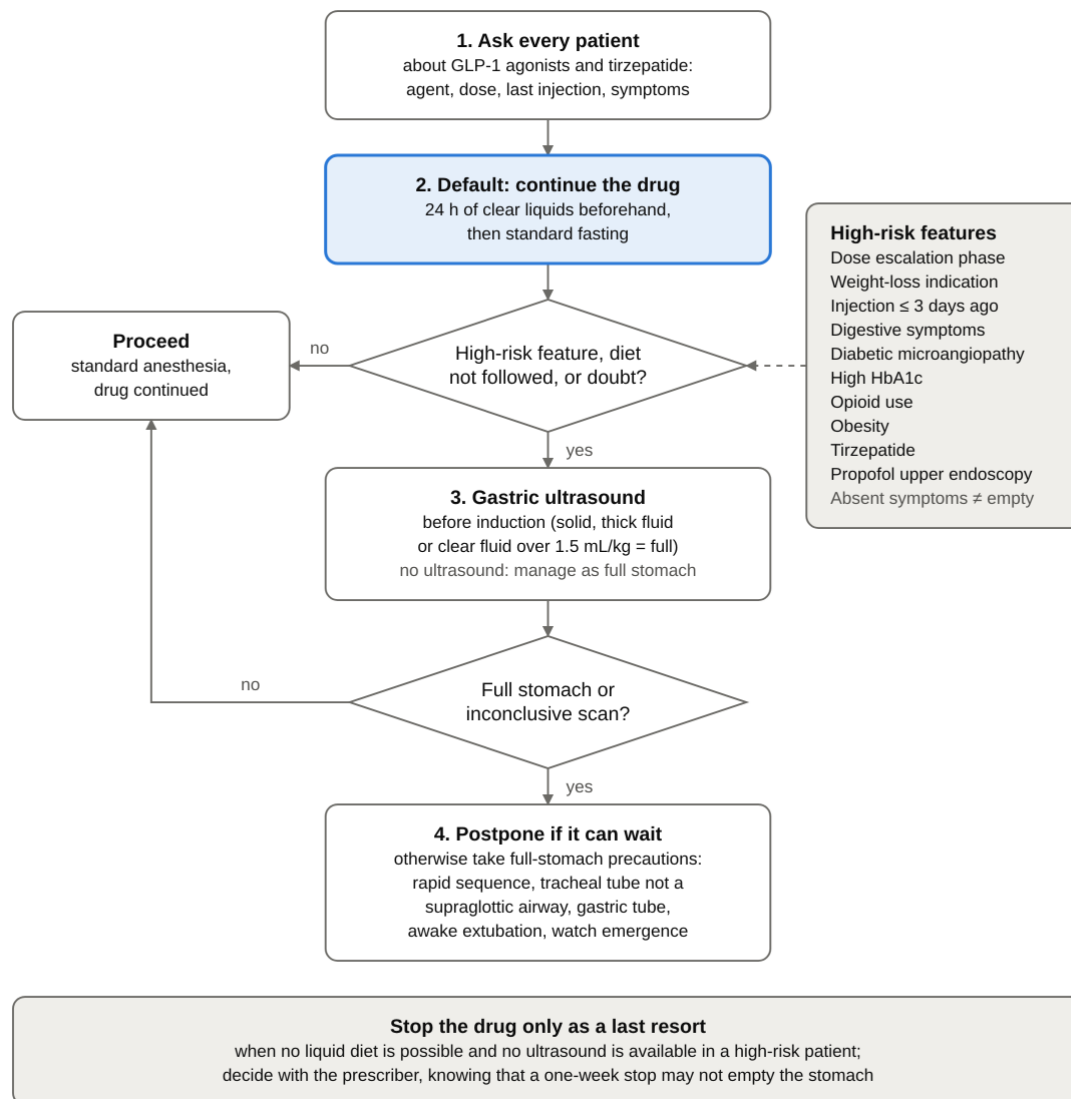


Figure 3: Proposed algorithm for patients taking GLP-1 receptor agonists before elective anesthesia or procedural sedation. The strategy reflects observational evidence and expert consensus and has not been validated prospectively. GLP-1: glucagon-like peptide-1; HbA1c: glycated hemoglobin.

DISCUSSION

Principal findings. This review of 106 studies shows a consistent physiological and surrogate signal, an inconsistent clinical signal and a convergence of recommendations. GLP-1 RAs delay solid gastric emptying, and residual gastric content is more frequent despite standard fasting, with pooled ORs of about 4 to 6. Coded aspiration is not increased in large databases, whereas direct reporting by anesthesiologists reveals substantially more regurgitation, often at emergence. A one-week interruption reduces but does not abolish the risk, whereas a clear-liquid diet the day before appears to remove most of the excess.

Implications for practice. Residual content is a necessary but not sufficient condition for aspiration. The critical moments are those at which airway reflexes are lost or recovering: induction, unprotected sedation with propofol and emergence [1,65,70]. This supports a strategy that acts on the stomach with a liquid diet, identifies residual risk with clinical screening and ultrasound, and protects the airway when risk persists, rather than one that relies on interruption, which is neither reliably effective within a week nor free of metabolic cost [17,26]. Where gastric ultrasound is not routinely available, high-risk patients should be managed as having a full stomach. No included study came from Africa, which limits the transferability of this evidence to our setting.

Strengths and limitations. This review is based on a systematic search of two databases through October 2026 and includes the first randomized trial, a national prospective cohort and eight guidelines published since 2024. It has several limitations. It is a narrative review, and half of the data were extracted from abstracts, which limited the available detail and precluded a formal risk-of-bias assessment. Screening was performed by a single author, supported by an artificial intelligence assistant rather than a second human reviewer. The search did not include terms such as surgery or sedation, which citation searching only partly compensated for. Most studies were observational and retrospective, with heterogeneous definitions of residual content and aspiration, exposure based on prescriptions rather than confirmed intake, and little information on interruption or fasting. Seventy percent of the studies came from the United States.

Research agenda. Priorities include a randomized comparison of a 24-hour liquid diet with interruption under general anesthesia, prospective validation of high-risk features and ultrasound-guided pathways, specific data on tirzepatide, high doses and oral agents, standardized reporting of regurgitation and aspiration, and data from Africa and the Middle East.

CONCLUSIONS

Routine interruption of GLP-1 RAs before elective anesthesia is not supported by current evidence: a one-week interruption does not reliably empty the stomach and carries metabolic costs. The full-stomach risk should instead be individualized: continue treatment, prescribe a 24-hour clear-liquid diet, screen for high-risk features, use gastric ultrasound when in doubt, and apply full-stomach precautions through emergence when risk remains. Where gastric ultrasound is unavailable, high-risk patients should be managed as having a full stomach. The certainty of the evidence is low, and randomized trials under general anesthesia are needed.

APPENDICES:

Appendix 1: Search strategy

Both databases were searched on October 6, 2026. The reference lists of included reviews and guidelines were also screened, which added four studies (Figure 1).

PubMed (publication dates 2023-2026; 333 records): (semaglutide OR liraglutide OR tirzepatide OR GLP-1) AND (anesthesia OR perioperative OR endoscopy) AND (aspiration OR gastric)

Scopus (PUBYEAR > 2022; 414 records): TITLE-ABS-KEY((semaglutide OR liraglutide OR tirzepatide OR "GLP-1") AND (anesthesia OR perioperative OR endoscopy) AND (aspiration OR gastric)) AND PUBYEAR > 2022

Appendix 2: Characteristics of the included studies

Table 4: Characteristics of the 106 included studies

Study (country)	Theme	Design; setting	Total n (GLP-1 RA users)	Key finding	Data source
Chen 2026 [21] (Canada)	Gastric emptying	SR/MA; gastric emptying studies	10 studies (300)	Gastric emptying half-time prolonged by 74 min (46-101); 116 min with short-acting agents and 82 min in the first 10 weeks; very low certainty.	Full text
Hiramoto 2024 [20] (USA)	Gastric emptying	SR/MA; gastric emptying studies	15 studies (658)	Scintigraphic half-time 138.4 vs. 95.0 min, difference 36.0 min (17.0-55.0); no significant delay with the acetaminophen (liquid) method; no effect of agent, duration of action or treatment duration.	Full text
Abdulraheem 2025 [35] (USA)	Residual content	SR/MA; upper endoscopy	20 studies; 207,708 (23,366)	RGC OR 5.57 (4.07-7.62), adjusted 3.18 (2.75-3.67); aborted procedures OR 4.90 (2.94-8.18); aspiration OR 1.75 (0.64-4.77); concomitant colonoscopy protective (OR 0.27); no difference between agents in network meta-analysis.	Abstract
Ahmed 2026 [30] (USA)	Residual content	SR/MA; upper endoscopy	28 studies; 212,082	RGC OR 3.95 (2.69-5.82), I ² 83%; cancelled procedure OR 3.96 (2.87-5.56); repeat procedure OR 1.82 (0.81-4.09); aspiration <1% in both groups, OR 1.09 (0.46-2.60).	Full text
Baig 2025 [31] (USA)	Residual content	SR/MA; endoscopy	23 studies; 262,018 (96,521)	Retained content OR 4.54 (3.30-6.24), moderate certainty; premature termination OR 4.54 (3.05-6.75); same-day colonoscopy OR 0.28 (0.22-0.36); aspiration pneumonia 0.19% vs. 0.19%, OR 0.96 (0.53-1.75).	Full text
do Nascimento 2024 [37] (USA/Brazil)	Residual content	SR/MA; surgery and procedures	14 studies; 2,143	Preprocedural GI symptoms OR 7.66 (3.42-17.17); RGC OR 6.08 (2.86-12.94); better glycemic control; no difference in hypoglycemia, PONV or 30-day mortality; one aspiration, not pooled.	Full text
Facciorusso 2025 [34] (Italy)	Residual content	SR/MA; upper endoscopy; mostly deep sedation	13 studies; 84,065	RGC OR 5.56 (3.35-9.23), adjusted 4.20 (3.42-5.15), persisting after fasting ≥12 h (5.47); aborted 1% vs. 0.3%, OR 5.13 (3.01-8.75); aspiration 0.3% vs. 0.2%, OR 1.75 (0.64-4.77).	Full text
Malandris 2026 [32] (Greece/UK)	Residual content	SR/MA; upper endoscopy	24 studies; 184,707 (59,095)	RGC OR 4.82 (3.66-6.35); aborted OR 3.93 (2.42-6.39); aspiration OR 1.11 (0.84-1.48), 1.09 (0.82-1.46) in studies at low risk of bias.	Full text
Singh 2025 [39] (USA)	Residual content	SR/MA; upper endoscopy and colonoscopy	23 studies; 77,152 (4,449)	Retained content OR 15.39 (4.65-50.99); aborted OR 13.86 (4.42-43.43); aspiration OR 21.06 (0.13-3,379), uninformative; bowel preparation OR 0.94 (0.67-1.31).	Abstract
Tarar 2025 [38] (USA)	Residual content	SR/MA; upper endoscopy	12 studies; 105,515 (32,144)	RGC OR 6.30 (5.30-7.49), adjusted 3.91 (3.21-4.62); aspiration 0.73% vs. 0.35%, OR 1.26 (0.86-1.87); aborted OR 5.50; same-day colonoscopy OR 0.26; RGC highest with tirzepatide (18.9%).	Full text
Li 2026 [44] (China)	Residual content	Prospective; fasted participants with type 2 diabetes	390 (224)	Increased content 53.3% vs. 32.1% after matching, OR 2.52 (1.84-3.45); retinopathy (OR 1.84) and nephropathy (OR 1.67) predictive; each day since the last dose OR 0.77 (0.65-0.90).	Abstract

Study (country)	Theme	Design; setting	Total n (GLP-1 RA users)	Key finding	Data source
Nersessian 2024 [42] (Brazil)	Residual content	Prospective; elective surgery; gastric ultrasound	220 (107)	Increased content 40% vs. 3%, weighted OR 36.97 (16.54-99.32); still elevated after holding 8-10 days; no aspiration.	Full text
Oates 2026 [46] (USA)	Residual content	Prospective; elective surgery; gastric ultrasound	117 (60)	No difference in gastric volume (-2.65 mL, 97.5% CI -26.5 to 21.2) or weight-adjusted volume; solids in 13 participants, evenly distributed; median last dose 9 days before.	Abstract
Sen 2024 [41] (USA)	Residual content	Prospective; elective procedures under anesthesia; gastric ultrasound	124 (62)	Increased RGC 56% vs. 19%; adjusted PR 2.48 (1.23-4.97), +30.5 percentage points; hold duration not associated (aOR 0.86).	Abstract
Sherwin 2023 [6] (USA)	Residual content	Prospective; volunteers without obesity	20 (10)	Residual solids 70% vs. 10% supine (RR 3.50, 1.26-9.65) and 90% vs. 20% lateral; empty stomach 2 h after water in 30% vs. 90%.	Full text
Vlaeminck 2026 [43] (Belgium)	Residual content	Prospective; elective surgery; gastric ultrasound	88 (44)	Full stomach 49% vs. 18%, OR 4.29 (1.63-11.29); solids 42% vs. 7%, OR 9.85 (2.57-37.76); calculated volume not different.	Abstract
Abu-Freha 2024 [24] (Israel)	Residual content	Retrospective; outpatient upper endoscopy	120,879 (1,671)	RGC 5.6% vs. 2.0%, aOR 2.13 (1.70-2.68); excess present with diabetes (6.2% vs. 3.0%) and without (4.2% vs. 1.9%); 5.6% vs. 1.6% against matched controls.	Full text
Bahdi 2026 [85] (USA)	Residual content	Retrospective; upper endoscopy ± colonoscopy; mostly MAC	417 upper endoscopies (212)	Retention 4.7% vs. 1% (p = 0.03): 9.5% with upper endoscopy alone vs. 0% when combined with colonoscopy; aborted 1.9% vs. 0.5% (NS); bowel preparation unaffected; no aspiration.	Abstract
Chang 2026 [81] (China)	Residual content	Retrospective; upper endoscopy ± colonoscopy	3,746 (43)	Case-control: GLP-1 RA aOR 13.31 (5.07-34.93) for residual content; diabetic complications OR 8.89; residue in 19 of 22 users (86.4%) despite same-day colonoscopy; no aspiration.	Full text
Chapman 2024 [86] (USA)	Residual content	Retrospective; upper endoscopy	168 (84)	Poorer mucosal visibility (2.42-fold odds of a low score); retained content 13.1% vs. 4.8%, aOR 4.62 (p = 0.025); more aborted procedures; no anesthesia events.	Abstract
Dev 2025 [87] (USA)	Residual content	Retrospective; upper endoscopy	32,275 (1,179)	Procedures aborted for retained food in 0.6% (7/1,179) vs. 0.096% (p < 0.01); no aspiration among patients with retained food.	Abstract
El Sabagh 2026 [48] (USA)	Residual content	Retrospective; upper endoscopy; predominantly African American patients	1,408 (270)	RGC aOR 1.52 (0.58-3.99), NS; no more aborted procedures or complications; fewer post-procedure admissions (OR 0.19, 0.06-0.58).	Full text
Elimihele 2024 [54] (USA)	Residual content	Retrospective; upper endoscopy ± colonoscopy	3,415 (34)	Residue 3.8% overall and 8.8% (3/34) in users, OR 2.5 (0.75-8.29), NS; all three users had another risk factor (opioid, anticholinergic or glucose 302 mg/dL); opioids present in 35% of residue cases.	Full text
Garza 2024 [50] (USA)	Residual content	Retrospective; upper endoscopy ± colonoscopy	306 users + matched controls	Solid residue 14% vs. 4%, 15% vs. 2% with complicated diabetes; less residue with clear liquids plus colonoscopy (2% vs. 11%) and afternoon procedures (4% vs. 11%); when residue was found, 22% were intubated and 25% terminated early; no aspiration.	Abstract

Study (country)	Theme	Design; setting	Total n (GLP-1 RA users)	Key finding	Data source
Gu 2025 [27] (USA)	Residual content	Retrospective; elective upper endoscopy	304 (152)	RGC 12.5% vs. 1.3% ($p < 0.0001$); 23% when prescribed for weight loss vs. 2.6% for diabetes; no effect of dose or duration; 6 of 19 affected procedures aborted.	Full text
Hisada 2025 [28] (Japan)	Residual content	Retrospective; screening upper endoscopy	296 matched (148)	Retained content 12.2% vs. 3.4% after propensity matching ($p = 0.009$), consistent across subgroups; more repeat endoscopies; no aspiration pneumonia.	Abstract
Korlipara 2024 [88] (USA)	Residual content	Retrospective; upper endoscopy $\pm$ colonoscopy	1,212 (602)	Semaglutide independently predicted retained solids (OR 4.74, 2.40-9.35); same-day colonoscopy protective (OR 0.41, 0.23-0.73); intubation rare and unrelated; no aspiration.	Abstract
Nadeem 2024 [25] (USA)	Residual content	Retrospective; upper endoscopy	35,183 (922)	RGC 13.6% vs. 2.3%, aOR 4.08 (3.25-5.12), with diabetes (aOR 3.78) and without (aOR 5.66); aborted aOR 3.87 (2.03-7.37); repeat aOR 2.09; no aspiration among users.	Full text
Nasser 2024 [89] (USA)	Residual content	Retrospective; upper endoscopy and/or colonoscopy	209 (70)	Food retention 4/23 (17.4%) vs. 0/46 with upper endoscopy alone, none with combined colonoscopy; inadequate bowel preparation 21.3% vs. 6.5%; no aspiration.	Secondary
Oh 2025 [40] (South Korea)	Residual content	Retrospective; upper endoscopy; diabetes	493 matched (198)	Inadequate mucosal visibility 8.6% vs. 1.4%, OR 6.14 (2.29-20.32); interrupted and repeated procedures 7.6% vs. 0.7%; no aspiration.	Abstract
Panchal 2025 [90] (USA)	Residual content	Retrospective; outpatient upper endoscopy $\pm$ colonoscopy	360 users, 298 controls	Solid content OR 3.80 (1.57-9.21), not increased with combined colonoscopy; aborted 1.3% vs. 0% ($p = 0.021$); hypoxia 0.2% vs. 0.3%; no aspiration.	Abstract
Patel 2026 [49] (USA)	Residual content	Retrospective; upper endoscopy	150 (73)	No significant association between GLP-1 RA use and food retention graded with the TiGR scale ($p = 0.67$); users had more gastroparesis and diabetes.	Abstract
Quinn 2025 [29] (USA)	Residual content	Retrospective; elective upper endoscopy; propofol	940 (470)	RGC 12.6% vs. 5.5%; OR 1.86 (1.04-3.42), propensity-weighted 1.92 (1.04-3.53); suspected aspiration 2 vs. 1, none confirmed.	Full text
Robalino Gonzaga 2024 [53] (USA)	Residual content	Retrospective; upper endoscopy	1,046 (73)	Retention associated with GLP-1 RA (OR 9.19, 2.73-30.8; highest with tirzepatide) and diabetes (OR 5.6); same-day colonoscopy protective (OR 0.18); no increase in aspiration.	Abstract
Silveira 2023 [7] (Brazil)	Residual content	Retrospective; upper endoscopy; deep sedation or GA	404 (33)	RGC 24.2% vs. 5.1%; semaglutide OR 5.15 (1.92-12.92) and GI symptoms OR 3.56; combined colonoscopy protective (OR 0.25); hold duration not associated; one aspiration (semaglutide group).	Abstract
Ukwade 2025 [91] (USA)	Residual content	Retrospective; upper endoscopy $\pm$ colonoscopy	1,284 (128)	RGC 14.1% vs. 3.8%; independent predictors GLP-1 RA (OR 5.4), gastroparesis (4.55) and chronic kidney disease (3.47); same-day colonoscopy preparation protective (OR 0.157); no excess complications.	Full text
Wu 2024 [92] (USA)	Residual content	Retrospective; upper endoscopy under anesthesia care	192 procedures (90)	Visible gastric content 19% vs. 5%, aOR 5.8 (1.7-19.3); urgent intubations 5 vs. 1; one aspiration in a user.	Abstract

Study (country)	Theme	Design; setting	Total n (GLP-1 RA users)	Key finding	Data source
Firkins 2025 [22] (USA)	Residual content	Uncontrolled series; upper endoscopy ± colonoscopy	1,512 (all users)	RGC 9.4% (solid in 78.9%), 11.6% with GI symptoms; aborted 2.0%; two mild aspirations (0.1%); same-day colonoscopy protective (aOR 0.34, 0.23-0.51).	Full text
Le 2026 [93] (USA)	Residual content	Uncontrolled series; upper endoscopy	218 (all users)	Retained content 20.6%; nine procedures aborted; one aspiration and one intubation during the procedure.	Abstract
Wen 2025 [94] (USA)	Residual content	Uncontrolled series; upper endoscopy	144 (12)	Residual content in 11/12 (92%) patients treated >6 months vs. 0/132 others; no complications or aspiration.	Full text
Adalier 2026 [95] (Italy)	Aspiration	SR/MA; endoscopy, elective and urgent surgery	20 comparative studies	Pulmonary complications not consistently increased; retained content more frequent; procedures abandoned in 0-2%; a single aspiration (1 vs. 0) across comparative studies.	Full text
Al-Majmoei 2026 [96] (NR)	Aspiration	SR/MA; elective non-bariatric surgery	7 cohorts (426 to 275,970 each)	Aspiration rare and not consistently increased with use or continuation; more RGC in endoscopy cohorts without clinical consequence; more pseudarthrosis and dysphagia after orthopedic or spine surgery (exploratory); low to very low certainty.	Abstract
Castrillon 2025 [36] (Australia)	Aspiration	SR/MA; surgery and endoscopy	28 studies	Aspiration OR 1.04 (0.87-1.25; 9 studies, 185,414 patients, 471 events, low certainty); RGC OR 5.96 (3.96-8.98); holding ≥1 dose reduced RGC (OR 0.51, 0.33-0.81), not robust to publication-bias adjustment (0.67, 0.38-1.18).	Full text
Chang 2024 [97] (USA)	Aspiration	SR/MA; endoscopy and anesthesia	24 studies and case reports	Scoping review: more RGC in 7 of 8 comparative studies (19-56% vs. 5-20%); no difference in aspiration in 3 retrospective studies (4.8 vs. 4.6 per 10,000); nearly all case reports confounded.	Full text
Elmati 2025 [55] (USA)	Aspiration	SR/MA; endoscopy, mainly upper	12 studies; 210,216 (87,691)	Aspiration 0.16% vs. 0.12%; OR 1.23 (0.58-2.60), high heterogeneity.	Full text
Ho 2025 [56] (USA)	Aspiration	SR/MA; elective surgery and upper endoscopy	7 studies	Aspiration RR 1.00 (0.76-1.30) for surgery and 1.10 (0.95-1.27) for endoscopy; opioids as positive control RR 2.68 (1.89-3.81), showing the approach could detect a risk.	Full text
Merhavy 2026 [98] (USA)	Aspiration	SR/MA; surgery and endoscopy	32 articles	Most studies found more residual content, but associations with regurgitation or aspiration were inconsistent and heavily confounded.	Full text
Tan 2025 [33] (China)	Aspiration	SR/MA; upper and capsule endoscopy	39 studies; 1,253,498	RGC OR 4.86 (3.85-6.14); aspiration OR 2.29 (1.36-3.87); aborted OR 3.22 (1.65-6.29); repeat OR 2.16 (1.14-4.11); capsule gastric transit +45.5 min.	Abstract
Wajda 2026 [99] (NR)	Aspiration	SR/MA; hip and knee arthroplasty	13 cohorts; 1,408,609	No association with aspiration or pneumonia; fewer prosthetic infections (OR 0.77), revisions and readmissions; more periprosthetic fractures at 1 year (OR 1.49).	Abstract
Mahmoud Issa 2025 [71] (Denmark)	Aspiration	Prospective; hip and knee arthroplasty; mostly spinal ± sedation	426 (all users)	No aspiration (0/426; 95% CI 0-0.9%) although 92% continued treatment until surgery; no stay >2 days due to delayed emptying.	Full text
Potter 2026 [1] (UK)	Aspiration	Prospective; all surgery; mostly GA	47,039 (1,348)	National cohort: aspiration and/or regurgitation 1.41% (1 in 71) vs. 0.12%, OR 11.39 (6.47-20.05); two confirmed aspirations in users; 53% of events at emergence; gastric ultrasound used in 1.3%.	Full text

Study (country)	Theme	Design; setting	Total n (GLP-1 RA users)	Key finding	Data source
Al Sakka Amini 2024 [100] (USA)	Aspiration	Retrospective; elective upper endoscopy; sedation	118,646 (59,323)	Aspiration pneumonitis within 24 h in 10 users (0.017%) vs. 0 controls; respiratory failure or ICU admission 0.029% vs. 0.038%, aOR 0.75 (0.40-1.46); same results at 48 h.	Full text
Albanese 2026 [101] (NR)	Aspiration	Retrospective; elective lipoabdominoplasty; GA	196 (98)	No clinically relevant respiratory event; intraoperative course, recovery, discharge, PONV and early complications comparable.	Abstract
Alkabbani 2024 [63] (USA)	Aspiration	Retrospective; upper endoscopy ± colonoscopy	43,365 (24,817)	Aspiration 4.15 vs. 4.26 per 1,000, RR 0.98 (0.73-1.31); discontinued procedure 9.79 vs. 4.91 per 1,000, RR 1.99 (1.56-2.53), mainly with BMI ≥30; no difference by anesthesia care.	Full text
Amen 2026 [102] (USA)	Aspiration	Retrospective; elective shoulder arthroplasty	2,219 (1:4 matching)	No difference in PONV (p = 0.892), intraoperative aspiration (p = 0.409) or 1-year complications.	Abstract
Anazco 2024 [103] (USA)	Aspiration	Retrospective; upper endoscopy	4,134 endoscopies (2,968 users)	Two aspirations (4.8 per 10,000 procedures), similar to 4.6 per 10,000 in a historical cohort without GLP-1 RA; one, with retained food, required intubation and 3 days of ICU care.	Secondary
Barlowe 2025 [64] (USA)	Aspiration	Retrospective; outpatient upper endoscopy	274,211 (15,119)	Pulmonary events rare (6-25 per 10,000); vs. DPP-4 inhibitor users, aspiration RR 0.67 (0.25-1.75), aspiration pneumonia 0.95, pneumonia 1.07, respiratory failure 0.75; lower risks than in chronic opioid users.	Full text
Chen 2025 [57] (USA)	Aspiration	Retrospective; 14 common surgical procedures	366,476 (5,931)	Aspiration pneumonia 0.7% vs. 0.6%; aOR 0.78 (0.57-1.06), stable in five sensitivity analyses; acute respiratory failure aOR 0.98 (0.89-1.06).	Full text
Chhabra 2025 [104] (USA)	Aspiration	Retrospective; colonoscopy	253,326 (126,663)	Aspiration pneumonia RR 0.70 (0.50-0.98); no difference in mechanical ventilation, respiratory failure or hospitalization.	Abstract
Choi 2026 [61] (USA)	Aspiration	Retrospective; surgery	NR	No increase in aspiration against metformin, DPP-4 or SGLT2 inhibitor users; lower mortality vs. metformin (RR 0.44, 0.31-0.64) and DPP-4 inhibitors (RR 0.63, 0.45-0.89).	Abstract
Fanizza 2026 [74] (USA)	Aspiration	Retrospective; surgery under GA	62,688 (31,344)	Users vs. non-users: pneumonia or pneumonitis 1.34% vs. 2.05% (OR 0.65), difficult or failed intubation 0.17% vs. 0.16% (OR 1.02), PONV OR 1.22 (1.13-1.32); pneumonitis higher in users with asthma, COPD or heart failure.	Full text
Heo 2026 [105] (USA)	Aspiration	Retrospective; elective anterior cervical spine fusion	3,196 (1,598)	Postoperative aspiration 0.81% vs. 1.25% (p = 0.39); fewer thromboses and acute kidney injuries.	Abstract
Hyung 2026 [106] (Canada)	Aspiration	Retrospective; ambulatory eye surgery; mild to moderate sedation	45,636 visits (1,596)	No aspiration in either group; desaturation OR 1.22 (0.38-3.88); PONV requiring an antiemetic OR 1.93 (1.29-2.89).	Abstract
Kalsi 2025 [107] (USA)	Aspiration	Retrospective; outpatient upper endoscopy and colonoscopy	4,242 (953)	No aspiration in either group; less post-procedure oxygen use (OR 0.43, 0.25-0.76); hospitalization OR 0.73 (0.39-1.36).	Abstract

Study (country)	Theme	Design; setting	Total n (GLP-1 RA users)	Key finding	Data source
Klonoff 2024 [108] (USA)	Aspiration	Retrospective; 9 elective procedures; GA with intubation	13,361 ($\approx$ 2,200)	No difference in aspiration or pneumonitis, ileus, hypoglycemia or 30-day mortality; fewer delayed-emptying events and less antiemetic use; consistent in diabetes plus obesity.	Abstract
Kotecha 2026 [67] (USA)	Aspiration	Retrospective; elective surgery	2,510 (655)	Target trial emulation: postoperative respiratory complications 5.5% vs. 3.5%, HR 1.61 (1.08-2.39); higher with age $\geq$ 50 years, type 2 diabetes and exenatide or lixisenatide (HR 2.97).	Conference abstract
Milne 2024 [70] (Canada)	Aspiration	Retrospective; all surgery; incident audit	31,816 procedures (552 elective users)	Elective surgery: regurgitation or aspiration in 3/552 users vs. 14/26,315 non-users, OR 10.27 (2.94-35.82); events at induction, after supraglottic airway insertion and at extubation.	Full text
Omurzakov 2025 [109] (USA)	Aspiration	Retrospective; elective shoulder arthroplasty	4,258 (2,129)	No significant difference in complications after matching; aspiration at 1 year 0.9% vs. 1.1% ($p = 0.444$); 90-day aspiration too rare to compare.	Full text
Peng 2024 [66] (USA)	Aspiration	Retrospective; upper endoscopy and colonoscopy	82,004 (29,820)	Recent (<1 month) vs. earlier users: aspiration pneumonia RR 1.14 (0.88-1.47); no increase vs. never-users or by procedure, GA or dosing interval.	Abstract
Poeran 2025 [58] (USA)	Aspiration	Retrospective; elective and urgent surgery	884,621 (17,688)	Aspiration 0.06% overall; aOR 0.81 (0.45-1.45), matched OR 0.89 (0.58-1.36); pneumonia aOR 0.79 (0.66-0.95); respiratory failure aOR 0.95 (0.79-1.14).	Full text
Stryelkina 2026 [110] (USA)	Aspiration	Retrospective; upper endoscopy and colonoscopy	13,523 (713)	No aspiration among users; aspiration more frequent after upper endoscopy (aOR 2.36) and in Black patients (aOR 2.77); GLP-1 RA not associated.	Abstract
Velji-Ibrahim 2025 [62] (USA)	Aspiration	Retrospective; endoscopy, mostly colonoscopy	46,948 (23,474)	Aspiration pneumonitis 0.11% vs. 0.12%, HR 0.92 (0.54-1.56); pneumonia HR 1.01 (0.83-1.24); no difference by procedure or agent.	Full text
Welk 2024 [60] (Canada)	Aspiration	Retrospective; elective surgery; GA or spinal	17,905 (3,833)	Postoperative pneumonia at 14 days 2.61 vs. 3.48 per 1,000, OR 0.71 (0.36-1.41); no excess aspiration-specific outcomes or bronchoscopies.	Secondary
Wright 2025 [59] (USA)	Aspiration	Retrospective; elective surgery	392,065 (15,745)	Aspiration 0.8% vs. 0.7% ($p = 0.61$); aOR 1.07 (0.85-1.34).	Abstract
Wu 2026 [68] (USA)	Aspiration	Retrospective; surgery; type 2 diabetes	592,778 (296,389)	Respiratory complications 0.09% vs. 0.34%, RR 0.26 (0.22-0.29); aspiration 0.01% vs. 0.03%, RR 0.31 (0.20-0.49); similar for long- and short-acting agents.	Abstract
Yang 2026 [69] (USA)	Aspiration	Retrospective; upper endoscopy and/or colonoscopy	3,261,113 endoscopies ($\approx$ 111,000)	Aspiration 0.11% overall; adjusted RR 0.70 (0.54-0.92), weighted 0.67 (0.51-0.87); short- and long-acting agents similar.	Full text
Yeo 2024 [65] (USA)	Aspiration	Retrospective; upper endoscopy and/or colonoscopy	31,816 (15,908)	Aspiration pneumonia 0.83% vs. 0.63%, HR 1.33 (1.02-1.74); HR 1.49 with propofol and 1.48 for upper endoscopy alone; no association for colonoscopy alone or for SGLT2 or DPP-4 inhibitor use.	Full text
Khak 2025 [2] (USA)	Aspiration	Uncontrolled series; distal radius fracture surgery	4,811 (46)	Use rose from 0.4% to 2.9% a year; one nausea (2.2%); no aspiration or serious complication among users.	Abstract

Study (country)	Theme	Design; setting	Total n (GLP-1 RA users)	Key finding	Data source
Palmer 2025 [73] (USA)	Aspiration	Uncontrolled series; elective joint arthroplasty	83 (all users)	No intraoperative aspiration; one full stomach requiring a nasogastric tube (escalation phase, semaglutide 1 mg 5 days before); 90-day medical complications 4.8%, none attributed to GLP-1 RA.	Abstract
Zapp 2026 [72] (USA)	Aspiration	Uncontrolled series; elective eye surgery; moderate sedation	155 procedures (all users)	Semaglutide continued: no aspiration or respiratory complication (0/155); one nausea, no vomiting; stable SpO ₂ .	Full text
Ahmad 2026 [17] (USA)	Interruption/fasting	RCT; upper endoscopy ± colonoscopy; moderate sedation or MAC	60 analyzed (all users)	OCULUS trial: RGC 25.0% when continued vs. 3.1% after holding one dose (difference 21.9%, 90% CI 7.0-36.7), stopped early; 46.7% vs. 5.0% for upper endoscopy alone, 0% in both arms with colonoscopy preparation; no aspiration.	Full text
Abdallah 2026 [16] (Jordan)	Interruption/fasting	SR/MA; elective endoscopy and surgery	19 studies + 1 database	A 24-h liquid diet, interruption ≥7-8 days and gastric ultrasound were each associated with less residual content; aspiration rare (0/426 in one prospective study; 0.8% vs. 0.7%, aOR 1.07 (0.85-1.34) in one database).	Full text
Boudreau 2026 [23] (Canada)	Interruption/fasting	Prospective; elective surgery; gastric ultrasound	93 (52)	RESIDUAL study: increased content in 42% of users after holding ≥7 days vs. 24% of controls; adjusted PR 1.65 (0.70-3.70); solids in 82% of positive scans; no effect of hold duration (OR 1.08 per day) or dose.	Full text
Pai 2026 [52] (USA)	Interruption/fasting	Prospective; surgery and procedures; gastric ultrasound	316 (all users)	Elevated gastric content in 35.8%; associated with hold ≤7.5 days, solid fast ≤21.3 h and recent opioid use; no effect of indication, route or treatment duration.	Abstract
Shahidifar 2026 [47] (USA)	Interruption/fasting	Prospective; fasted participants; gastric POCUS	134 (74)	Solids 5.4% vs. 5.0% (p = 0.56); among users, solids with shorter fasts (10.9 vs. 13.1 h); volume fell 2.26 mL per fasting hour; time since last dose not associated.	Abstract
Wolla 2025 [45] (USA)	Interruption/fasting	Prospective; elective surgery; gastric ultrasound	206 (106)	Median volume 0.61 vs. 0.16 mL/kg; full stomach OR 11.3 (5.2-24.7); higher volume if last dose <7 days, no difference between 7-14 and >14 days; surgery delayed or cancelled 5.6% vs. 0%; one aspiration in a user.	Full text
Dong 2026 [75] (China)	Interruption/fasting	Retrospective; upper endoscopy ± colonoscopy	16,067 (165)	RGC 0.4% in non-users, 5.83% with continuation (OR 10.68, 3.74-30.55) and 1.61% after a 2-week hold (OR 2.99, 0.37-23.89); obesity (BMI ≥28) raised risk about 10-fold despite holding.	Abstract
Jirapinyo 2025 [76] (USA)	Interruption/fasting	Retrospective; bariatric upper endoscopy	629 (all users)	Continued (n = 483) vs. held (n = 146): early termination 1.4% vs. 0% (p = 0.36); RGC 6.4% vs. 2.7% (p = 0.09); no aspiration.	Abstract
Phan 2025 [51] (USA)	Interruption/fasting	Retrospective; endoscopy	815 (all users)	Retained content 8.7% (93% in patients with diabetes); 4.4% with ASA-concordant hold vs. 12.7% without (p < 0.001); 36% higher risk per 1% HbA1c; one unplanned intubation, no aspiration.	Abstract
Santos 2024 [26] (Brazil/Canada)	Interruption/fasting	Retrospective; upper endoscopy; deep sedation or GA	1,094 (123)	RGC 20.3% vs. 3.2%; weighted OR 10.0 if held <8 days and 4.59 at 8-14 days; GI symptoms OR 15.1; only a hold >14 days without symptoms lost the association (OR 0.77, 0.22-2.01); one aspiration.	Full text

Study (country)	Theme	Design; setting	Total n (GLP-1 RA users)	Key finding	Data source
Skidmore 2025 [111] (USA)	Interruption/fasting	Retrospective; ambulatory urologic surgery	107 (all users)	Recovery-room SpO2 decrease 1.5% (hold <7 days) vs. 1.8% (≥ 7 days), $p = 0.41$; similar glucose; larger decrease with morbid obesity (2.29% vs. 1.43%).	Full text
Trykall 2026 [78] (USA)	Interruption/fasting	Retrospective; elective surgery	168 encounters (all users)	Before-and-after comparison: perioperative glycemic control similar whether treatment was continued or held (77.8% vs. 82.8% on target, $p = 0.44$; 80.7% vs. 84.2% after matching).	Abstract
Muranaka 2025 [82] (USA)	Strategy/guidance	Prospective; elective surgery; gastric POCUS	25 (all users)	Empty stomach in 20/25, operated the same day without complication; solids in 5/25, postponed; full stomach in 3/4 with last dose 1-3 days before vs. 2/21 at 4-6 days ($p = 0.02$).	Full text
Wilson 2026 [79] (USA)	Strategy/guidance	Prospective; elective upper endoscopy; sedation	256 (NR)	Retained content 8% vs. 6% ($p = 0.55$); no aspiration, aborted procedure or conversion to GA; endoscopist concern more frequent (19% vs. 7%).	Abstract
Ghazanfar 2024 [80] (USA)	Strategy/guidance	Retrospective; upper endoscopy $\pm$ colonoscopy	306 (all users)	Food residue 1.5% after a liquid diet vs. 10% on a regular diet ($p = 0.03$); residue in 13% of symptomatic patients, all on a regular diet; no complications or aspiration.	Full text
Mendez-Pino 2026 [77] (USA)	Strategy/guidance	Retrospective; upper endoscopy	337 (all users)	Retained content 8.4%; solid fast >15 h protective (aOR 0.33, 0.13-0.81); hold <7 days aOR 5.23 (0.67-39.38), NS; liquid fast, diabetes and treatment duration not associated.	Abstract
Maselli 2024 [112] (USA)	Strategy/guidance	Uncontrolled series; endoscopic sleeve gastropasty	57 (all users)	GLP-1 RAs continued: no retained solids, aspiration, regurgitation or hypoxia.	Abstract
Tsakas 2026 [84] (NR)	Strategy/guidance	Uncontrolled series; surgery; single-center audit	118 (all users)	Semaglutide identified at preassessment in 75% and aspiration risk documented in 33%; gastric ultrasound and prokinetics each used in 3.4%; no adverse events.	Abstract
Bang 2026 [14] (South Korea)	Strategy/guidance	Guideline; anesthesia for surgery and procedures	NA	Korean Society of Anesthesiologists: continue in most patients; 24-h clear-liquid diet; gastric ultrasound if symptoms or diet not followed; an inconclusive scan does not mean an empty stomach.	Full text
El-Boghdadly 2025 [10] (UK)	Strategy/guidance	Guideline; elective surgery and procedures	NA	UK multidisciplinary consensus: continue GLP-1 RAs; shared decision-making; usual fasting; symptoms do not predict gastric content; consider gastric ultrasound and mitigation (regional anesthesia, RSI, awake extubation).	Full text
Facciorusso 2026 [13] (Italy)	Strategy/guidance	Guideline; upper endoscopy and colonoscopy	NA (meta-analysis update, 18 studies)	Italian Society of Gastroenterology: no routine interruption before upper endoscopy (conditional, very low evidence); liquid diet the day before for long procedures or symptoms; updated RGC OR 5.43 (3.72-7.91); no extra measures for colonoscopy.	Full text
Haskins 2026 [83] (USA)	Strategy/guidance	Guideline; regional anesthesia and pain procedures	NA	ASRA Pain Medicine recommendations: gastric ultrasound recommended in labor, urgent cesarean delivery and diabetes; conditional support for GLP-1 RA users, obesity, emergencies and enteral feeding; complements clinical judgment.	Abstract
Hocking 2025 [12] (Australia/NZ)	Strategy/guidance	Guideline; surgery, endoscopy and sedation	NA	ADS/ANZCA/GESA/NACOS: ask every patient; continue therapy; 24-h clear-liquid diet plus 6-h fast; if not followed, gastric ultrasound or light-sedation endoscopy and	Abstract

Study (country)	Theme	Design; setting	Total n (GLP-1 RA users)	Key finding	Data source
Kindel 2024 [9] (USA)	Strategy/guidance	Guideline; surgery and GI endoscopy	NA	IV erythromycin; absent symptoms do not stratify risk; no hold interval can be recommended as sufficient.	Full text
Oprea 2025 [11] (USA)	Strategy/guidance	Guideline; surgery and procedures	NA	AGA/ASMBS/ASA/ISPCOP/SAGES guidance: identify high-risk features (escalation, high dose, weekly agent, GI symptoms, other gastroparesis); continue if absent; if present, shared decision, 24-h liquid diet, gastric ultrasound, RSI or postponement.	Full text
Triantafyllou 2026 [15] (Europe)	Strategy/guidance	Guideline; GI endoscopy under sedation	NA	SPAQI consensus: continue unless significant GI symptoms; 24-h solid fast, sugared liquids until 8 h and clear liquids until 4 h; refer symptomatic patients to the prescriber before surgery.	Abstract
				ESGE/ESGENA guideline: individualize sedation in GLP-1 RA users (conditional recommendation, very low-quality evidence); propofol first line; capnography when the risk of hypoxemia is increased.	

Studies are grouped by theme, then by design and first author. Values in parentheses after effect estimates are 95% CIs unless stated otherwise; comparisons are GLP-1 RA users vs. non-users unless stated otherwise. Data source: full text, published abstract, conference abstract, or secondary sources (supplementary material and tables of published reviews) for research letters without an abstract. ADS: Australian Diabetes Society; AGA: American Gastroenterological Association; ANZCA: Australian and New Zealand College of Anaesthetists; aOR: adjusted odds ratio; ASA: American Society of Anesthesiologists; ASMBS: American Society for Metabolic and Bariatric Surgery; ASRA: American Society of Regional Anesthesia and Pain Medicine; BMI: body mass index; CI: confidence interval; COPD: chronic obstructive pulmonary disease; DPP-4: dipeptidyl peptidase-4; ESGE: European Society of Gastrointestinal Endoscopy; ESGENA: European Society of Gastroenterology and Endoscopy Nurses and Associates; GA: general anesthesia; GESA: Gastroenterological Society of Australia; GI: gastrointestinal; GLP-1 RA: glucagon-like peptide-1 receptor agonist; HbA1c: glycated hemoglobin; HR: hazard ratio; ICU: intensive care unit; ISPCOP: International Society of Perioperative Care of Patients with Obesity; IV: intravenous; MAC: monitored anesthesia care; NA: not applicable; NACOS: National Association of Clinical Obesity Services; NR: not reported; NS: not significant; NZ: New Zealand; OR: odds ratio; POCUS: point-of-care ultrasound; PONV: postoperative nausea and vomiting; PR: prevalence ratio; RCT: randomized controlled trial; RGC: residual gastric content; RR: risk ratio; RSI: rapid sequence induction; SAGES: Society of American Gastrointestinal and Endoscopic Surgeons; SGLT2: sodium-glucose cotransporter-2; SPAQI: Society for Perioperative Assessment and Quality Improvement; SpO2: peripheral oxygen saturation; SR/MA: systematic review or meta-analysis; TiGR: Tampa Intraluminal Gastric Residue; UK: United Kingdom; USA: United States.

ACKNOWLEDGEMENTS

Author Contributions. All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work. Concept and design: Acquisition, analysis, or interpretation of data. Drafting of the manuscript: Ahmed Fakri. Critical review of the manuscript for important intellectual content . Supervision: Mustapha Bensghir

Disclosures. Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Acknowledgements. The authors used Claude (Anthropic) to draft the manuscript and to prepare the figures. The authors reviewed and edited all content, verified all data against the source documents and take full responsibility for the content of this publication.

REFERENCES

1. Potter TE, Cronin JN, Kua J, et al.: Peri-operative glucagon-like peptide-1 receptor agonist use and outcomes: a national prospective multicentre cohort study. *Anaesthesia*. 2026, 10.1111/anae.70380
<https://doi.org/10.1111/anae.70380>
2. Khak M, Adams JA, Hozien M, Ilyas AM: GLP-1 receptor agonist use in patients undergoing distal radius fracture surgery: a retrospective review of perioperative considerations. *Cureus*. 2025, 17:e89183. 10.7759/cureus.89183
<https://doi.org/10.7759/cureus.89183>
3. Nauck MA, Kemmeries G, Holst JJ, Meier JJ: Rapid tachyphylaxis of the glucagon-like peptide 1-induced deceleration of gastric emptying in humans. *Diabetes*. 2011, 60:1561-5. 10.2337/db10-0474
<https://doi.org/10.2337/db10-0474>
4. Umapathysivam MM, Lee MY, Jones KL, et al.: Comparative effects of prolonged and intermittent stimulation of the glucagon-like peptide 1 receptor on gastric emptying and glycemia. *Diabetes*. 2014, 63:785-90. 10.2337/db13-0893
<https://doi.org/10.2337/db13-0893>
5. Urva S, Coskun T, Loghin C, et al.: The novel dual glucose-dependent insulinotropic polypeptide and glucagon-like peptide-1 (GLP-1) receptor agonist tirzepatide transiently delays gastric emptying similarly to selective long-acting GLP-1 receptor agonists. *Diabetes Obes Metab*. 2020, 22:1886-91. 10.1111/dom.14110
<https://doi.org/10.1111/dom.14110>
6. Sherwin M, Hamburger J, Katz D, DeMaria SJ: Influence of semaglutide use on the presence of residual gastric solids on gastric ultrasound: a prospective observational study in volunteers without obesity recently started on semaglutide. *Can J Anaesth*. 2023, 70:1300-6. 10.1007/s12630-023-02549-5
<https://doi.org/10.1007/s12630-023-02549-5>

7. Silveira SQ, da Silva LM, de Campos Vieira Abib A, et al.: Relationship between perioperative semaglutide use and residual gastric content: a retrospective analysis of patients undergoing elective upper endoscopy. *J Clin Anesth.* 2023, 87:111091.

10.1016/j.jclinane.2023.111091

<https://doi.org/10.1016/j.jclinane.2023.111091>

8. Joshi GP, Abdelmalak BB, Weigel WA, et al.: American Society of Anesthesiologists consensus-based guidance on preoperative management of patients (adults and children) on glucagon-like peptide-1 (GLP-1) receptor agonists. (2023). Accessed: October 15, 2026: <https://www.asahq.org/about-asa/newsroom/news-releases/2023/06/american-society-of-anesthesiologists-consensus-based-guidance-on-preoperative>

9. Kindel TL, Wang AY, Wadhwa A, et al.: Multisociety clinical practice guidance for the safe use of glucagon-like peptide-1 receptor agonists in the perioperative period. *Surg Obes Relat Dis.* 2024, 20:1183-6. 10.1016/j.soard.2024.08.033

<https://doi.org/10.1016/j.soard.2024.08.033>

10. El-Boghdadly K, Dhesei J, Fabb P, et al.: Elective peri-operative management of adults taking glucagon-like peptide-1 receptor agonists, glucose-dependent insulintropic peptide agonists and sodium-glucose cotransporter-2 inhibitors: a multidisciplinary consensus statement. *Anaesthesia.* 2025, 80:412-24. 10.1111/anae.16541

<https://doi.org/10.1111/anae.16541>

11. Oprea AD, Ostapenko LJ, Sweitzer B, et al.: Perioperative management of patients taking glucagon-like peptide 1 receptor agonists: Society for Perioperative Assessment and Quality Improvement (SPAQI) multidisciplinary consensus statement. *Br J Anaesth.* 2025, 135:48-78. 10.1016/j.bja.2025.04.001

<https://doi.org/10.1016/j.bja.2025.04.001>

12. Hocking SL, Scott DA, Remedios ML, et al.: 2025 ADS/ANZCA/GESA/NACOS clinical practice recommendations on the peri-procedural use of GLP-1/GIP receptor agonists. *Anaesth Intensive Care.* 2025, 53:300-6. 10.1177/0310057X251355288

<https://doi.org/10.1177/0310057X251355288>

13. Facciorusso A, Giannini EG, Tacelli M, et al.: Practical management of glucagon-like peptide-1 receptor agonists in gastroenterology: a position paper by the Italian Society of Gastroenterology (SIGE). *Dig Liver Dis.* 2026, 58:737-46. 10.1016/j.dld.2026.02.018

<https://doi.org/10.1016/j.dld.2026.02.018>

14. Bang YJ, Choi JH, Min JJ, Park SY, Choi WK, Hwang JY, Koo BN: Korean consensus-based recommendations for preanesthetic gastric ultrasound and anesthetic considerations for GLP-1 receptor agonist-based therapy: a consensus statement from Clinical Practice Guideline Committee of the Korean Society of Anesthesiologists. *Korean J Anesthesiol.* 2026, 79:466-87. 10.4097/kja.26655

<https://doi.org/10.4097/kja.26655>

15. Triantafyllou K, Tziatzios G, Tham TC, et al.: Sedation for gastrointestinal endoscopy: European Society of Gastrointestinal Endoscopy (ESGE) and European Society of Gastroenterology and Endoscopy Nurses and Associates (ESGENA) guideline. *Endoscopy.* 2026, 58:1142-79. 10.1055/a-2898-6540

<https://doi.org/10.1055/a-2898-6540>

16. Abdallah OW, Albashtawi A, Aljabr S, et al.: Peri-procedural fasting and gastric ultrasound strategies in glucagon-like peptide-1 (GLP-1) receptor agonist users: a systematic review with qualitative synthesis. *Cureus*. 2026, 18:e108216. 10.7759/cureus.108216
<https://doi.org/10.7759/cureus.108216>
17. Ahmad AI, Garg S, Jacobs J, et al.: Holding vs continuing GLP-1/GIP agonists before upper endoscopy: the OCULUS randomized clinical trial. *JAMA Intern Med*. 2026, 186:578-84. 10.1001/jamainternmed.2026.0027
<https://doi.org/10.1001/jamainternmed.2026.0027>
18. Baethge C, Goldbeck-Wood S, Mertens S: SANRA-a scale for the quality assessment of narrative review articles. *Res Integr Peer Rev*. 2019, 4:5. 10.1186/s41073-019-0064-8
<https://doi.org/10.1186/s41073-019-0064-8>
19. Page MJ, McKenzie JE, Bossuyt PM, et al.: The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021, 372:n71. 10.1136/bmj.n71
<https://doi.org/10.1136/bmj.n71>
20. Hiramoto B, McCarty TR, Lodhia NA, et al.: Quantified metrics of gastric emptying delay by glucagon-like peptide-1 agonists: a systematic review and meta-analysis with insights for periprocedural management. *Am J Gastroenterol*. 2024, 119:1126-40. 10.14309/ajg.0000000000002820
<https://doi.org/10.14309/ajg.0000000000002820>
21. Chen A, Zhao K, Ceban F, Nabipour M, Englesakis M, Chung F, Perlas A: Glucagon-like peptide-1 receptor agonists and gastric emptying time: a systematic review and meta-analysis of prospective studies. *Can J Anaesth*. 2026, 73:345-56. 10.1007/s12630-026-03114-6
<https://doi.org/10.1007/s12630-026-03114-6>
22. Firkins SA, Yates J, Shukla N, Garg R, Vargo JJ, Lembo A: Clinical outcomes and safety of upper endoscopy while on glucagon-like peptide-1 receptor agonists. *Clin Gastroenterol Hepatol*. 2025, 23:872-873.e3. 10.1016/j.cgh.2024.03.013
<https://doi.org/10.1016/j.cgh.2024.03.013>
23. Boudreau C, Couture M, Rousseau-Saine N, et al.: Residual gastric content after holding of glucagon-like peptide-1 receptor agonists before elective surgery: a cross-sectional study - the RESIDUAL study. *BMC Anesthesiol*. 2026, 26:511. 10.1186/s12871-026-03999-2
<https://doi.org/10.1186/s12871-026-03999-2>
24. Abu-Freha N, Levi Z, Nevo-Shor A, et al.: The impact of glucagon-like peptide-1 receptor agonist on the gastric residue in upper endoscopy. *Diabetes Res Clin Pract*. 2024, 217:111900. 10.1016/j.diabres.2024.111900
<https://doi.org/10.1016/j.diabres.2024.111900>
25. Nadeem D, Taye M, Still MD, et al.: Effects of glucagon-like peptide-1 receptor agonists on upper endoscopy in diabetic and nondiabetic patients. *Gastrointest Endosc*. 2024, 100:745-9. 10.1016/j.gie.2024.04.2900
<https://doi.org/10.1016/j.gie.2024.04.2900>
26. Santos LB, Mizubuti GB, da Silva LM, et al.: Effect of various perioperative semaglutide interruption intervals on residual gastric content assessed by esophagogastroduodenoscopy: a retrospective single center observational study. *J Clin Anesth*. 2024, 99:111668.

10.1016/j.jclinane.2024.111668

<https://doi.org/10.1016/j.jclinane.2024.111668>

27. Gu GH, Pauplis C, Seacor T, Devuni D, Krishnarao A: Association of semaglutide with retained gastric contents on endoscopy: retrospective analysis. *Endosc Int Open*. 2025, 13:a25501468. 10.1055/a-2550-1468

<https://doi.org/10.1055/a-2550-1468>

28. Hisada H, Tsuji Y, Kubota D, et al.: Impact of glucagon-like peptide-1 receptor agonists on retained gastric contents during esophagogastroduodenoscopy: a propensity score-matched study. *Dig Endosc*. 2025, 37:1340-7. 10.1111/den.70016

<https://doi.org/10.1111/den.70016>

29. Quinn JA, Welch KM, Fujino E, Jimenez Rosado CA, An X, Schoenherr JW, Gouker LN: Perioperative glucagon-like peptide-1 receptor agonist use and retained gastric contents: a retrospective analysis of patients undergoing elective upper endoscopy. *J Clin Anesth*. 2025, 102:111776. 10.1016/j.jclinane.2025.111776

<https://doi.org/10.1016/j.jclinane.2025.111776>

30. Ahmed Z, Iqbal A, Ghazaleh S, et al.: Evaluating glucagon-like peptide-1 receptor agonist safety before upper endoscopy: a systematic review and meta-analysis. *Gastroenterology Res*. 2026, 19:64-73. 10.14740/gr2108

<https://doi.org/10.14740/gr2108>

31. Baig MU, Piazza A, Lahooti A, et al.: Glucagon-like peptide-1 receptor agonist use and the risk of residual gastric contents and aspiration in patients undergoing GI endoscopy: a systematic review and a meta-analysis. *Gastrointest Endosc*. 2025, 101:762-771.e13. 10.1016/j.gie.2024.12.019

<https://doi.org/10.1016/j.gie.2024.12.019>

32. Malandris K, Papachristou S, Derka LP, et al.: Effect of GLP-1 receptor agonists on upper gastrointestinal endoscopy outcomes: a systematic review and meta-analysis. *Ann Gastroenterol*. 2026, 39:452-63. 10.20524/aog.2026.1067

<https://doi.org/10.20524/aog.2026.1067>

33. Tan Y, Zhang X, Lv XH, Sun YN, Yang JL, Xiao X: Glucagon-like peptide-1 receptor agonists increase the risk of residual gastric content and pulmonary aspiration on upper endoscopy: a meta-analysis. *Dig Liver Dis*. 2025, 57:1377-85. 10.1016/j.dld.2025.03.002

<https://doi.org/10.1016/j.dld.2025.03.002>

34. Facciorusso A, Ramai D, Dhar J, et al.: Effects of glucagon-like peptide-1 receptor agonists on upper gastrointestinal endoscopy: a meta-analysis. *Clin Gastroenterol Hepatol*. 2025, 23:715-725.e3. 10.1016/j.cgh.2024.07.021

<https://doi.org/10.1016/j.cgh.2024.07.021>

35. Abdulraheem A, Abujaber B, Ayers L, et al.: Impact of GLP-1 receptor agonists on upper gastrointestinal endoscopy: an updated systematic review and meta-analysis. *Surg Endosc*. 2025, 39:5135-51. 10.1007/s00464-025-11962-4

<https://doi.org/10.1007/s00464-025-11962-4>

36. Castrillon J, Rele S, Sumithran P, et al.: Association between glucagon-like peptide-1 receptor agonist use and peri-operative pulmonary aspiration: a systematic review and meta-

analysis. *Anaesthesia*. 2025, 80:846-58. 10.1111/anae.16601
<https://doi.org/10.1111/anae.16601>

37. do Nascimento TS, Pereira ROL, Maia E, et al.: The impact of glucagon-like peptide-1 receptor agonists in the patients undergoing anesthesia or sedation: systematic review and meta-analysis. *Perioper Med (Lond)*. 2024, 13:78. 10.1186/s13741-024-00439-y
<https://doi.org/10.1186/s13741-024-00439-y>

38. Tarar ZI, Farooq U, Chaudhry A, et al.: Evidence report on the safety of gastrointestinal endoscopy in patients on glucagon-like peptide-1 receptor agonists: a systematic review and meta-analysis. *Diagnostics (Basel)*. 2025, 15:770. 10.3390/diagnostics15060770
<https://doi.org/10.3390/diagnostics15060770>

39. Singh S, Rahman SH, Khan N, et al.: Effects of glucagon-like peptide-1 receptor agonists on endoscopy outcomes: systematic review and meta-analysis. *Gastrointest Endosc*. 2025, 101:343-349.e5. 10.1016/j.gie.2024.10.011
<https://doi.org/10.1016/j.gie.2024.10.011>

40. Oh YE, Kim TS, Chi SA, et al.: Effect of glucagon-like peptide-1 receptor agonists on gastric mucosal visibility during upper endoscopy in Asian patients with diabetes. *World J Diabetes*. 2025, 16:112694. 10.4239/wjd.v16.i12.112694
<https://doi.org/10.4239/wjd.v16.i12.112694>

41. Sen S, Potnuru PP, Hernandez N, Goehl C, Praestholm C, Sridhar S, Nwokolo OO: Glucagon-like peptide-1 receptor agonist use and residual gastric content before anesthesia. *JAMA Surg*. 2024, 159:660-7. 10.1001/jamasurg.2024.0111
<https://doi.org/10.1001/jamasurg.2024.0111>

42. Nersessian RSF, da Silva LM, Carvalho MAS, et al.: Relationship between residual gastric content and peri-operative semaglutide use assessed by gastric ultrasound: a prospective observational study. *Anaesthesia*. 2024, 79:1317-24. 10.1111/anae.16454
<https://doi.org/10.1111/anae.16454>

43. Vlaeminck N, Van de Putte P, Dekeyser M, et al.: Gastric ultrasound in patients receiving semaglutide: a prospective, multicentre, matched control study. *Anaesthesia*. 2026, 81:801-9. 10.1111/anae.70129
<https://doi.org/10.1111/anae.70129>

44. Li XY, Jin Y, Feng XY, et al.: Prevalence and predictors of residual gastric content in patients with type 2 diabetes on GLP-1 receptor agonists: a prospective observational study. *Diabetes Obes Metab*. 2026, 28:3612-22. 10.1111/dom.70537
<https://doi.org/10.1111/dom.70537>

45. Wolla CD, Pecha TJ, Sirianni JM, Schorg LM, Wolf BJ, Wilson SH: Ultrasound assessment of preoperative gastric volume in fasted diabetic surgical patients: a prospective observational cohort study on the effects of glucagon-like peptide-1 agonists on gastric emptying. *J Clin Anesth*. 2025, 104:111853. 10.1016/j.jclinane.2025.111853
<https://doi.org/10.1016/j.jclinane.2025.111853>

46. Oates PL, McElrath AD, Boyd RP, Harcourt CA, Highland KB, Carness JM, Knuf KM: Glucagon like peptide-1 receptor agonist use not related with gastric volume after preoperative fasting: a prospective observational study. *Mil Med*. 2026, 191:e1006-e1011.

10.1093/milmed/usaf510

<https://doi.org/10.1093/milmed/usaf510>

47. Shahidifar E, Lesniowska M, Deschenes E, et al.: Fasting duration, not timing of last GLP-1 dose, predicts aspiration risk indicators: a prospective point-of-care gastric ultrasound study. *Dig Dis Sci*. 2026, 71:1926-36. 10.1007/s10620-025-09570-2

<https://doi.org/10.1007/s10620-025-09570-2>

48. El Sabagh A, Abdulraheem A, Jimenez A, et al.: The impact of GLP-1 receptor agonists on esophagogastroduodenoscopy outcomes: a retrospective cohort study in a predominantly African American population. *JGH Open*. 2026, 10:e70370. 10.1002/jgh3.70370

<https://doi.org/10.1002/jgh3.70370>

49. Patel Y, McDonald A, Taylor GM, Sher T, DuCoin C, Sujka J, Docimo S: A single-center retrospective review of food retention during upper endoscopy following GLP-1 receptor agonist usage and introduction of the Tampa Intraluminal Gastric Residue (TiGR) grading scale. *Surg Endosc*. 2026, 40:3454-60. 10.1007/s00464-026-12640-9

<https://doi.org/10.1007/s00464-026-12640-9>

50. Garza K, Aminpour E, Shah J, Mehta B, Early D, Gyawali CP, Kushnir V: Glucagon-like peptide-1 receptor agonists increase solid gastric residue rates on upper endoscopy especially in patients with complicated diabetes: a case-control study. *Am J Gastroenterol*. 2024, 119:1081-8. 10.14309/ajg.0000000000002777

<https://doi.org/10.14309/ajg.0000000000002777>

51. Phan J, Chang P, Issa D, et al.: Glucagon-like peptide receptor agonists use before endoscopy is associated with low retained gastric contents: a multicenter cross-sectional analysis. *Am J Gastroenterol*. 2025, 120:554-61. 10.14309/ajg.0000000000002969

<https://doi.org/10.14309/ajg.0000000000002969>

52. Pai SL, Nimma SR, Beam WB, et al.: Assessment of gastric content using gastric ultrasound in patients on glucagon-like peptide-1 receptor agonists before anesthesia. *Anesth Analg*. 2026, 142:640-9. 10.1213/ANE.0000000000007764

<https://doi.org/10.1213/ANE.0000000000007764>

53. Robalino Gonzaga E, Farooq A, Mohammed A, et al.: Real-world impact of GLP-1 receptor agonists on endoscopic patient outcomes in an ambulatory setting: a retrospective study at a large tertiary center. *J Clin Med*. 2024, 13:5403. 10.3390/jcm13185403

<https://doi.org/10.3390/jcm13185403>

54. Elimihle TA, Mangrola AM, Oshomoji O, et al.: Confounding factors in the association between glucagon-like peptide-1 receptor agonist use and retained gastric contents in asymptomatic patients undergoing upper gastrointestinal endoscopy: a retrospective study. *Cureus*. 2024, 16:e69152. 10.7759/cureus.69152

<https://doi.org/10.7759/cureus.69152>

55. Elmati PR, Jagirdhar GSK, Qasba RK, et al.: GLP-1 agonists and the risk of pulmonary aspiration during elective upper endoscopy: a systematic review and meta-analysis. *Open Respir Med J*. 2025, 19:e18743064372550. 10.2174/0118743064372550250603061720

<https://doi.org/10.2174/0118743064372550250603061720>

56. Ho CN, Ayers AT, Kohn MA, Umpierrez GE, Klonoff DC: Glucagon-like peptide-1 receptor agonists and peri-procedural aspiration risk. *J Endocr Soc.* 2025, 9:bvaf088.
10.1210/jendso/bvaf088
<https://doi.org/10.1210/jendso/bvaf088>
57. Chen YH, Zink T, Chen YW, et al.: Postoperative aspiration pneumonia among adults using GLP-1 receptor agonists. *JAMA Netw Open.* 2025, 8:e250081.
10.1001/jamanetworkopen.2025.0081
<https://doi.org/10.1001/jamanetworkopen.2025.0081>
58. Poeran J, Iban YC, Zhong H, et al.: Preoperative GLP-1 agonist use is not associated with perioperative aspiration or pneumonia: an observational study using US national data. *Br J Anaesth.* 2025, 134:1526-8. 10.1016/j.bja.2025.01.038
<https://doi.org/10.1016/j.bja.2025.01.038>
59. Wright JD, Chen L, Xu X, Hur C, Matsuo K, Elkin EB, Hershman DL: Glucagon-like-peptide-1 (GLP-1) receptor agonist use and the risk of pulmonary aspiration in patients undergoing surgery. *Int J Surg.* 2025, 111:4090-3. 10.1097/JS9.0000000000002425
<https://doi.org/10.1097/JS9.0000000000002425>
60. Welk B, McClure JA, Carter B, Clarke C, Dubois L, Clemens KK: No association between semaglutide and postoperative pneumonia in people with diabetes undergoing elective surgery. *Diabetes Obes Metab.* 2024, 26:4105-10. 10.1111/dom.15711
<https://doi.org/10.1111/dom.15711>
61. Choi UE, Nicholson RC, Messinger C, et al.: Preoperative glucagon-like peptide-1 receptor agonists and postoperative outcomes: an observational analysis. *Anesthesiology.* 2026, 10.1097/ALN.0000000000006326
<https://doi.org/10.1097/ALN.0000000000006326>
62. Velji-Ibrahim J, Nathani P, Patel HK, Sharma P: GLP-1 receptor agonist use does not increase risk of respiratory complications post-endoscopy. *Endosc Int Open.* 2025, 13:a24872937. 10.1055/a-2487-2937
<https://doi.org/10.1055/a-2487-2937>
63. Alkabbani W, Suissa K, Gu KD, et al.: Glucagon-like peptide-1 receptor agonists before upper gastrointestinal endoscopy and risk of pulmonary aspiration or discontinuation of procedure: cohort study. *BMJ.* 2024, 387:e080340. 10.1136/bmj-2024-080340
<https://doi.org/10.1136/bmj-2024-080340>
64. Barlowe TS, Anderson C, Sandler RS, et al.: Glucagon-like peptide-1 receptor agonists do not increase aspiration during upper endoscopy in patients with diabetes. *Clin Gastroenterol Hepatol.* 2025, 23:739-47. 10.1016/j.cgh.2024.04.038
<https://doi.org/10.1016/j.cgh.2024.04.038>
65. Yeo YH, Gaddam S, Ng WH, Huang PC, Motility and Metabolic Pharmacoevidence Group, Ma KS, Rezaie A: Increased risk of aspiration pneumonia associated with endoscopic procedures among patients with glucagon-like peptide 1 receptor agonist use. *Gastroenterology.* 2024, 167:402-4. 10.1053/j.gastro.2024.03.015
<https://doi.org/10.1053/j.gastro.2024.03.015>

66. Peng CY, Chang YC, Gong C, et al.: Association between glucagon-like peptide-1 receptor agonists and aspiration pneumonia during endoscopic procedures. *Anesthesiology*. 2024, 141:1009-12. 10.1097/ALN.0000000000005174
<https://doi.org/10.1097/ALN.0000000000005174>
67. Kotecha P, Donahoo WT, Sharma A, et al.: Preoperative GLP-1 receptor agonist use and postoperative respiratory complications in patients undergoing elective surgeries: a target trial emulation study. *Am J Respir Crit Care Med*. 2026, 212:369-73. 10.1164/rccm.202503-0775RL
<https://doi.org/10.1164/rccm.202503-0775RL>
68. Wu HL, Chen JT, Cata JP, Hsieh CH, Cherng YG, Tai YH: Risk of perioperative cardiorespiratory complications and mortality associated with preoperative glucagon-like peptide-1 receptor agonist use in type 2 diabetes mellitus: a nationwide propensity-score matched study. *Br J Anaesth*. 2026, 136:86-97. 10.1016/j.bja.2025.08.003
<https://doi.org/10.1016/j.bja.2025.08.003>
69. Yang JY, Chen L, Wright JD, Hur C: Glucagon-like peptide-1 receptor agonists are not associated with increased pulmonary aspiration during endoscopy and colonoscopy. *Clin Gastroenterol Hepatol*. 2026, 10.1016/j.cgh.2026.07.010
<https://doi.org/10.1016/j.cgh.2026.07.010>
70. Milne AD, Berry MA, Ellis MW, Dobson GR: Rates of glucagon-like peptide-1 receptor agonist use and aspiration events associated with anesthesia at a Canadian academic teaching centre. *Can J Anaesth*. 2024, 71:673-5. 10.1007/s12630-024-02761-x
<https://doi.org/10.1007/s12630-024-02761-x>
71. Mahmoud Issa L, Kehlet H, Madsbad S, et al.: Perioperative GLP1-RA management and risk of aspiration in patients with diabetes undergoing fast-track hip and knee arthroplasty. *Dan Med J*. 2025, 72:A09240629. 10.61409/A09240629
<https://doi.org/10.61409/A09240629>
72. Zapp C, Downer DM II, Levine A, Parker N, Zapp M, Downer D, Levine L: The risk of aspiration is low with continuing semaglutide during elective eye surgery when patients receive only moderate sedation. *Cureus*. 2026, 18:e102921. 10.7759/cureus.102921
<https://doi.org/10.7759/cureus.102921>
73. Palmer RC, Telang SS, Kistler NM, et al.: GLP-1 receptor agonist utilization is associated with a low risk of anesthesia-related complications prior to total joint arthroplasty. *Eur J Orthop Surg Traumatol*. 2025, 36:37. 10.1007/s00590-025-04604-x
<https://doi.org/10.1007/s00590-025-04604-x>
74. Fanizza JD, Sanjari Moghaddam A, Atrash A: Are patient factors associated with adverse perioperative outcomes in GLP-1 receptor agonist users? A retrospective cohort study. *J Clin Anesth*. 2026, 111:112192. 10.1016/j.jclinane.2026.112192
<https://doi.org/10.1016/j.jclinane.2026.112192>
75. Dong Z, Li O, Wu J, et al.: Effect of two-week perioperative glucagon-like peptide-1 receptor agonist interruption on retained gastric contents during esophagogastroduodenoscopy: a retrospective, observational study. *Surg Endosc*. 2026, 40:7721-8. 10.1007/s00464-026-13121-9
<https://doi.org/10.1007/s00464-026-13121-9>

76. Jirapinyo P, Siranart N, Thompson CC: Glucagon-like peptide-1 receptor agonists and upper endoscopy: a real-world experience. *Obesity (Silver Spring)*. 2025, 33:250-6. 10.1002/oby.24190
<https://doi.org/10.1002/oby.24190>
77. Mendez-Pino L, Goldblatt J, Godie D, et al.: Preoperative fasting status and retained gastric contents in patients undergoing endoscopy who are using glucagon-like peptide type 1 receptor agonists: a multicentre retrospective study. *Can J Anaesth*. 2026, 10.1007/s12630-026-03187-3
<https://doi.org/10.1007/s12630-026-03187-3>
78. Trykall CC, Hill SB, James AM, Bagnola AJ, Wyne KL, Handley D, Brower KI: Comparison of perioperative glycemic control in patients continuing versus temporarily holding glucagon-like peptide-1 receptor agonists or glucose-dependent insulinotropic polypeptide/glucagon-like peptide-1 receptor agonists preoperatively. *AACE Endocrinol Diabetes*. 2026, 13:452-62. 10.1016/j.aed.2026.02.002
<https://doi.org/10.1016/j.aed.2026.02.002>
79. Wilson PR, Wolf BJ, Bridges KH, Crawford D, Shah K, Wilson SH: Glucagon-like peptide-1 receptor agonists and retained gastric contents on endoscopy: a prospective observational study. *Can J Anaesth*. 2026, 10.1007/s12630-026-03186-4
<https://doi.org/10.1007/s12630-026-03186-4>
80. Ghazanfar H, Javed N, Qasim A, et al.: Is it necessary to stop glucagon-like peptide-1 receptor agonists prior to endoscopic procedure? A retrospective study. *World J Gastroenterol*. 2024, 30:3221-8. 10.3748/wjg.v30.i26.3221
<https://doi.org/10.3748/wjg.v30.i26.3221>
81. Chang S, Tang Y, Wang M, et al.: Impact of glucagon-like peptide-1 receptor agonists (GLP-1 RAs) on increased residual gastric content in patients with and without concurrent colonoscopy: a retrospective case-control study. *J Clin Med*. 2026, 15:2121. 10.3390/jcm15062121
<https://doi.org/10.3390/jcm15062121>
82. Muranaka MO, Nguyen TH, Wang AT, et al.: Role of gastric point-of-care ultrasound in perioperative management of semaglutide. *Cureus*. 2025, 17:e85791. 10.7759/cureus.85791
<https://doi.org/10.7759/cureus.85791>
83. Haskins SC, Bronshteyn YS, Ledbetter L, et al.: ASRA Pain Medicine narrative review and expert practice recommendations for gastric point-of-care ultrasound to assess aspiration risk in medically complex patients undergoing regional anesthesia and pain procedures. *Reg Anesth Pain Med*. 2026, 51:723-45. 10.1136/rapm-2024-106346
<https://doi.org/10.1136/rapm-2024-106346>
84. Tsakas JJ, Pattullo C, Stead M, Donovan P: Retrospective audit of the current anaesthetic peri-operative approach to patients prescribed semaglutide. *Perioper Care Oper Room Manag*. 2026, 44:100708. 10.1016/j.pcorn.2026.100708
<https://doi.org/10.1016/j.pcorn.2026.100708>
85. Bahdi F, Bachu VS, Aldzhyan V, et al.: The impact of glucagon-like peptide 1 receptor agonists versus diabetes mellitus on endoscopic procedures: a case-control study from a large tertiary care health system. *J Clin Gastroenterol*. 2026, 60:841-7.

10.1097/MCG.0000000000002414

<https://doi.org/10.1097/MCG.0000000000002414>

86. Chapman MB, Norwood DA, Price C, et al.: Effects of glucagon-like peptide-1 receptor agonists on gastric mucosal visibility and retained gastric contents during EGD. *Gastrointest Endosc.* 2024, 100:923-7. 10.1016/j.gie.2024.05.012
<https://doi.org/10.1016/j.gie.2024.05.012>

87. Dev B, Hadi Y, Rizvi A, Cao C, Horwich B, Hoerter NA: Low rates of aborted endoscopy due to gastric food retention in patients on glucagon-like-peptide-1 receptor agonists. *Dig Dis Sci.* 2025, 70:1838-43. 10.1007/s10620-025-08915-1
<https://doi.org/10.1007/s10620-025-08915-1>

88. Korlipara H, Chua J, Buckholz A, et al.: Semaglutide is an independent predictor of retained solid gastric contents, but same-day colonoscopy mitigates effect. *Tech Innov Gastrointest Endosc.* 2024, 26:316-22. 10.1016/j.tige.2024.07.001
<https://doi.org/10.1016/j.tige.2024.07.001>

89. Nasser J, Hosseini A, Barlow G, Gianchandani R, Rezaie A, Pimentel M, Mathur R: Food retention at endoscopy among adults using glucagon-like peptide-1 receptor agonists. *JAMA Netw Open.* 2024, 7:e2436783. 10.1001/jamanetworkopen.2024.36783
<https://doi.org/10.1001/jamanetworkopen.2024.36783>

90. Panchal S, Mahmud N, Atkins JH, et al.: Endoscopy and anesthesia outcomes associated with glucagon-like peptide-1 receptor agonist use in patients undergoing outpatient upper endoscopy. *Gastrointest Endosc.* 2025, 102:216-22. 10.1016/j.gie.2025.01.004
<https://doi.org/10.1016/j.gie.2025.01.004>

91. Ukwade D, Hernandez LJ, Modi Z, et al.: GLP-1 receptor agonist increase retained gastric contents on EGD and same-day colonoscopy reduces this risk. *Front Med (Lausanne).* 2025, 12:1638981. 10.3389/fmed.2025.1638981
<https://doi.org/10.3389/fmed.2025.1638981>

92. Wu F, Smith MR, Mueller AL, et al.: Association of glucagon-like peptide receptor 1 agonist therapy with the presence of gastric contents in fasting patients undergoing endoscopy under anesthesia care: a historical cohort study. *Can J Anaesth.* 2024, 71:958-66. 10.1007/s12630-024-02719-z
<https://doi.org/10.1007/s12630-024-02719-z>

93. Le K, Prasad S, Shah R: Impact of GLP-1 receptor agonists on gastric residuals in patients receiving gastrointestinal endoscopic procedures. *Proc (Bayl Univ Med Cent).* 2026, 39:25-8. 10.1080/08998280.2025.2583025
<https://doi.org/10.1080/08998280.2025.2583025>

94. Wen J, Puglisi J, Frezza E: Association between semaglutide or tirzepatide therapy and residual gastric content: a potential danger during upper endoscopy. *Cureus.* 2025, 17:e96771. 10.7759/cureus.96771
<https://doi.org/10.7759/cureus.96771>

95. Adalier E, Neto C, Shopi I, et al.: Perioperative anesthesia and aspiration-related outcomes in patients receiving GLP-1 receptor agonists undergoing urgent and elective procedures: a

systematic review. *Trends Anaesth Crit Care*. 2026, 68:101660. 10.1016/j.tacc.2026.101660
<https://doi.org/10.1016/j.tacc.2026.101660>

96. Al-Majmoei A, Alatoon M, Abdullahi F, et al.: Perioperative glucagon-like peptide-1 receptor agonist use and postoperative outcomes in adults with obesity undergoing elective non-bariatric surgery: a systematic review. *SN Compr Clin Med*. 2026, 8:431. 10.1007/s42399-026-02671-7
<https://doi.org/10.1007/s42399-026-02671-7>

97. Chang MG, Ripoll JG, Lopez E, Krishnan K, Bittner EA: A scoping review of GLP-1 receptor agonists: are they associated with increased gastric contents, regurgitation, and aspiration events? *J Clin Med*. 2024, 13:6336. 10.3390/jcm13216336
<https://doi.org/10.3390/jcm13216336>

98. Merhavy ZI, Kowal Z, Spencer T, Trachuk AM, Aldanese A, Ahmed Z, Arsene C: Perioperative anesthesia management of GLP-1 receptor agonists: a systematic review of potential risks. *Perioper Med (Lond)*. 2026, 15:27. 10.1186/s13741-026-00662-9
<https://doi.org/10.1186/s13741-026-00662-9>

99. Wajda B, Van Essen D, Martini S, Assadzadeh GE, Sharma R, Werle J: Glucagon-like peptide-1 receptor agonists in hip and knee arthroplasty: a comprehensive systematic review and meta-analysis of perioperative and postoperative outcomes. *Arthroplast Today*. 2026, 39:102043. 10.1016/j.artd.2026.102043
<https://doi.org/10.1016/j.artd.2026.102043>

100. Al Sakka Amini R, Ismail ALS, Al-Aqrabawi M, et al.: Risk of aspiration pneumonitis after elective esophagogastroduodenoscopy in patients on glucagon-like peptide-1 receptor agonists. *Cureus*. 2024, 16:e66311. 10.7759/cureus.66311
<https://doi.org/10.7759/cureus.66311>

101. Albanese R, Tomaselli F, Berkane Y, Bertheuil N, Tambasco D: Anesthetic safety and perioperative outcomes in GLP-1 receptor agonist-treated patients undergoing lipoabdominoplasty. *Aesthetic Plast Surg*. 2026, 10.1007/s00266-026-06232-0
<https://doi.org/10.1007/s00266-026-06232-0>

102. Amen TB, Liimakka A, Rudisill SS, Dean MC, Torabian KA, Dyer GS: Glucagon-like peptide-1 agonists and total shoulder arthroplasty outcomes: using natural language processing to assess postoperative risks and complications. *Semin Arthroplasty JSES*. 2026, 36:151556. 10.1016/j.sart.2026.151556
<https://doi.org/10.1016/j.sart.2026.151556>

103. Anazco D, Fansa S, Hurtado MD, Camilleri M, Acosta A: Low incidence of pulmonary aspiration during upper endoscopy in patients prescribed a glucagon-like peptide 1 receptor agonist. *Clin Gastroenterol Hepatol*. 2024, 22:1333-1335.e2. 10.1016/j.cgh.2023.11.024
<https://doi.org/10.1016/j.cgh.2023.11.024>

104. Chhabra P, Bhandari R, Singh R: Unmasking aspiration risks: a propensity-matched odyssey of GLP-1 receptor agonists and colonoscopy. *J Gastroenterol Hepatol*. 2025, 40:2732-7. 10.1111/jgh.70071
<https://doi.org/10.1111/jgh.70071>

105. Heo KY, Barchick SR, Sowa AM, Chao M, Rajan PV, Goh BC, Yoon ST: Glucagon-like peptide-1 receptor agonist use and perioperative outcomes after anterior cervical discectomy

and fusion: a propensity-matched cohort study. *Spine J.* 2026, 26:882-92.

10.1016/j.spinee.2025.12.019

<https://doi.org/10.1016/j.spinee.2025.12.019>

106. Hyung B, Ye XY, Chandrakumar M, Lovshin JA, Peacock SC: Perioperative desaturation and postoperative nausea or vomiting requiring antiemetic administration in glucagon-like peptide-1 receptor agonist users undergoing ambulatory ophthalmic surgery under mild-to-moderate sedation: a large retrospective cohort study. *Diabetes Obes Metab.* 2026, 28:7546-54. 10.1111/dom.70955

<https://doi.org/10.1111/dom.70955>

107. Kalsi H, Bassi R, Noureldine H, et al.: Peri-procedural safety of GLP-1 receptor agonists in elective endoscopy: a multicenter retrospective cohort study. *J Clin Med.* 2025, 14:6147.

10.3390/jcm14176147

<https://doi.org/10.3390/jcm14176147>

108. Klonoff DC, Kim SH, Galindo RJ, et al.: Risks of peri- and postoperative complications with glucagon-like peptide-1 receptor agonists. *Diabetes Obes Metab.* 2024, 26:3128-36.

10.1111/dom.15636

<https://doi.org/10.1111/dom.15636>

109. Omurzakov A, Omurzakov AM, Reddy RP, et al.: Perioperative glucagon-like peptide-1 receptor agonist use is not associated with increased complications in obese patients undergoing total shoulder arthroplasty: a propensity-matched large database study. *Semin Arthroplasty JSES.* 2025, 35:604-11. 10.1053/j.sart.2025.06.001

<https://doi.org/10.1053/j.sart.2025.06.001>

110. Stryelkina M, Molina R, Janice T, et al.: Aspiration risk during endoscopic procedures while on GLP-1 agonist therapy. *Dig Dis Sci.* 2026, 71:211-20. 10.1007/s10620-025-09307-1

<https://doi.org/10.1007/s10620-025-09307-1>

111. Skidmore KL, Le H, Segredo V, et al.: Pulse oximetry desaturation in the postoperative recovery room in patients with obesity and diabetes using GLP-1 agonists: a retrospective observational study. *Cureus.* 2025, 17:e87774. 10.7759/cureus.87774

<https://doi.org/10.7759/cureus.87774>

112. Maselli DB, Lee D, Bi D, Jirapinyo P, Thompson CC, Donnangelo LL, McGowan CE: Safe continuation of glucagon-like peptide 1 receptor agonists at endoscopy: a case series of 57 adults undergoing endoscopic sleeve gastropasty. *Obes Surg.* 2024, 34:2369-74.

10.1007/s11695-024-07278-2

<https://doi.org/10.1007/s11695-024-07278-2>