Considerations Of GLP-1 Agonists In Patients Presenting For Metabolic And Bariatric Surgery- Surgeon And Anesthesiologist's Perspective

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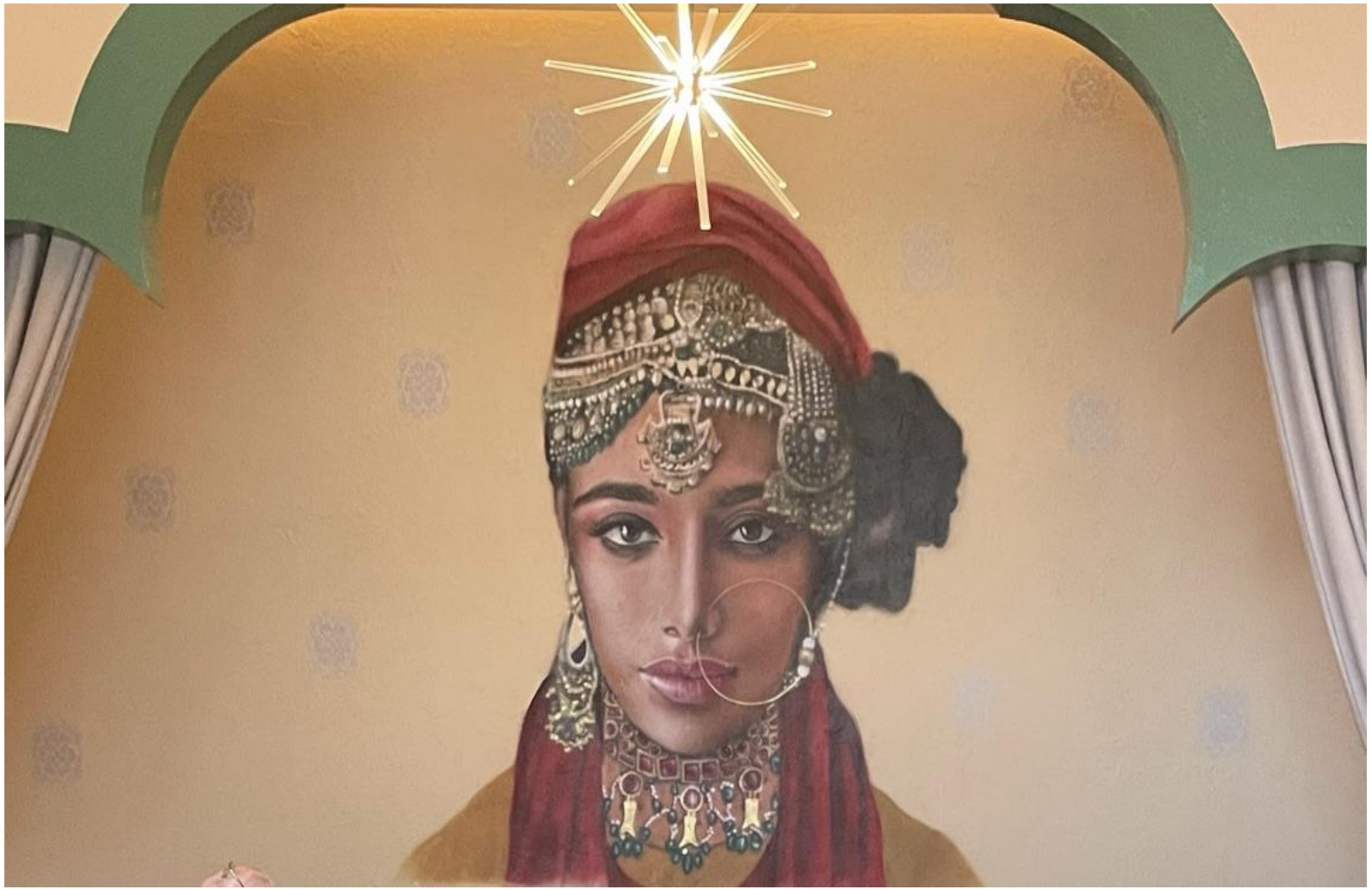
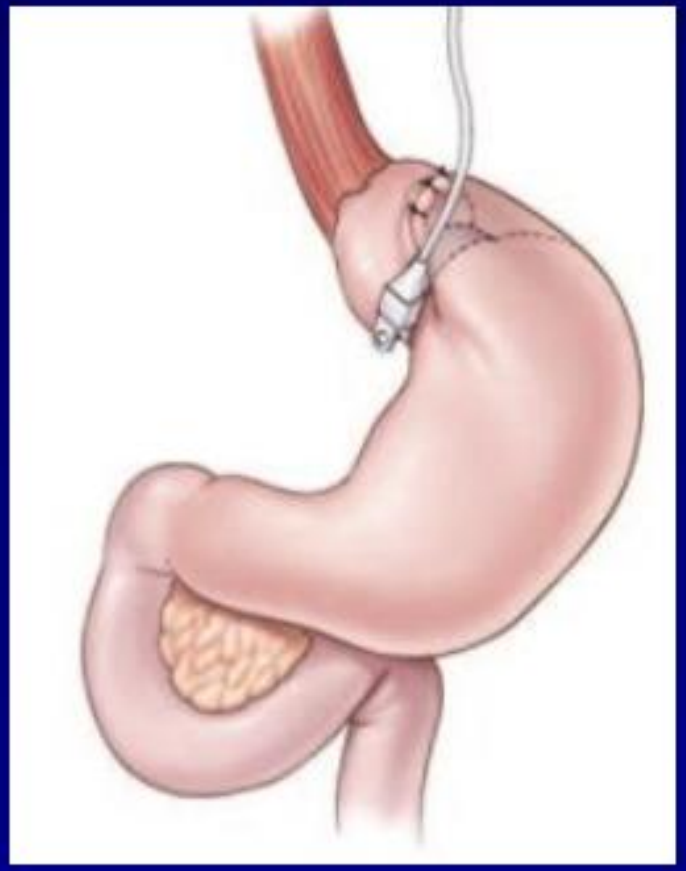
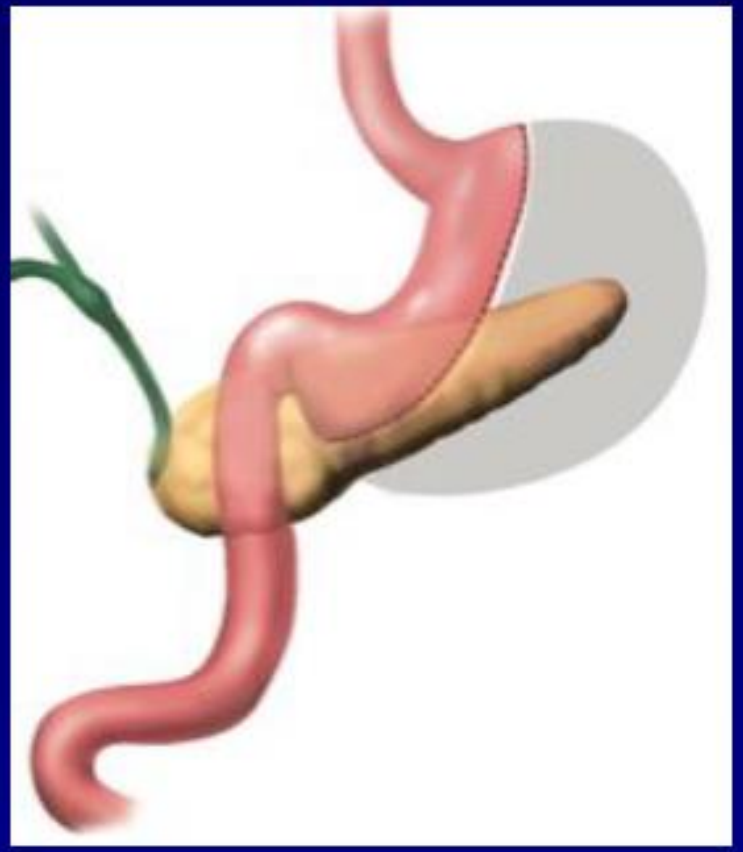
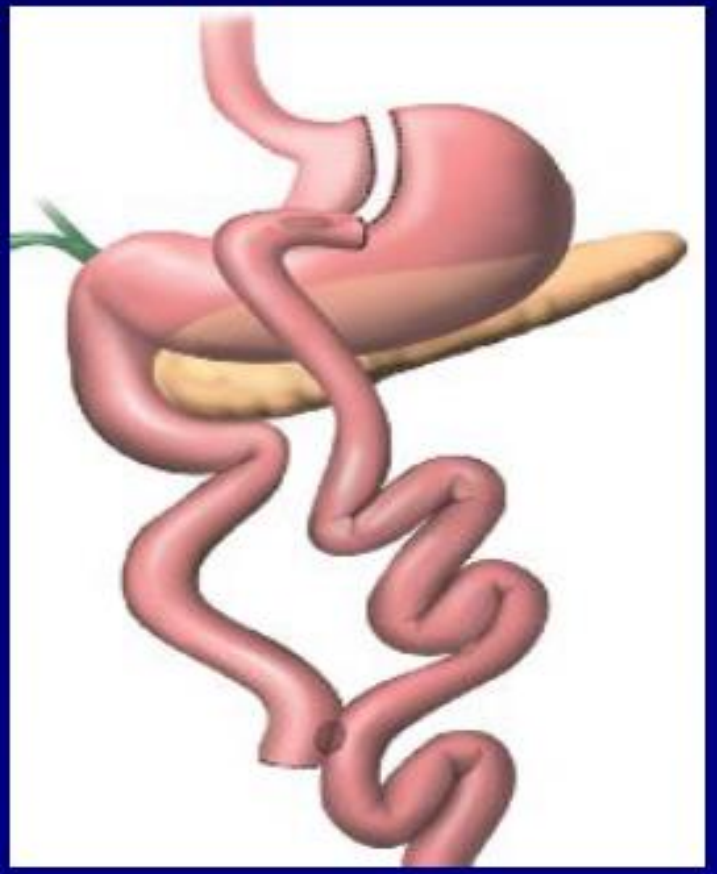
I HAVE NO FINANCIAL DISCLOSURES OR CONFLICT OF INTEREST



Adjustable Gastric Band < Vertical Sleeve Gastrectomy < Roux-en-Y Gastric Bypass





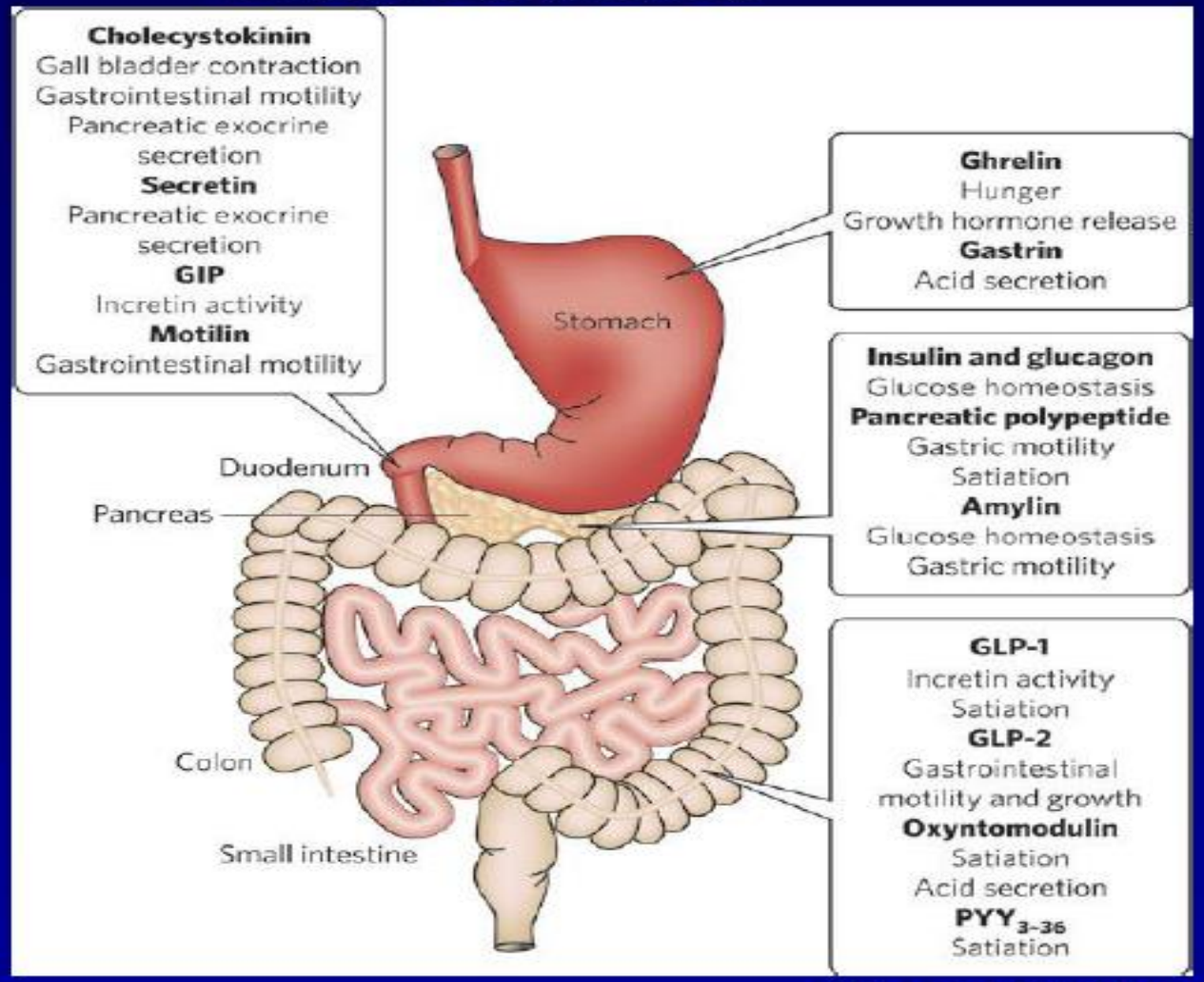


Mechanisms of Weight Loss After Bariatric Surgery

- ***Gastric Restriction:*** limits the amount of food consumed at one sitting. However, if this were the only mechanism constraining food intake, patients would be predicted to increase the frequency and caloric density of their meals.
- ***Dumping:*** encompasses nausea, flushing, bloating, faintness, fatigue, and diarrhea triggered by consumption of foods high in sugar and may cause patients to severely limit the intake of sweets. However, the severity of dumping does not correlate well with the amount of weight loss.
- ***Malabsorption:*** clinically significant malabsorption of macronutrients does not occur.
- ***Neurohormonal?***

Gut Hormones

- Hunger
- Satiety
- Meal Size
- Meal Frequency
- Insulin Sensitivity
- Insulin Secretion



Nature **444**, 854-859(14 December 2006)

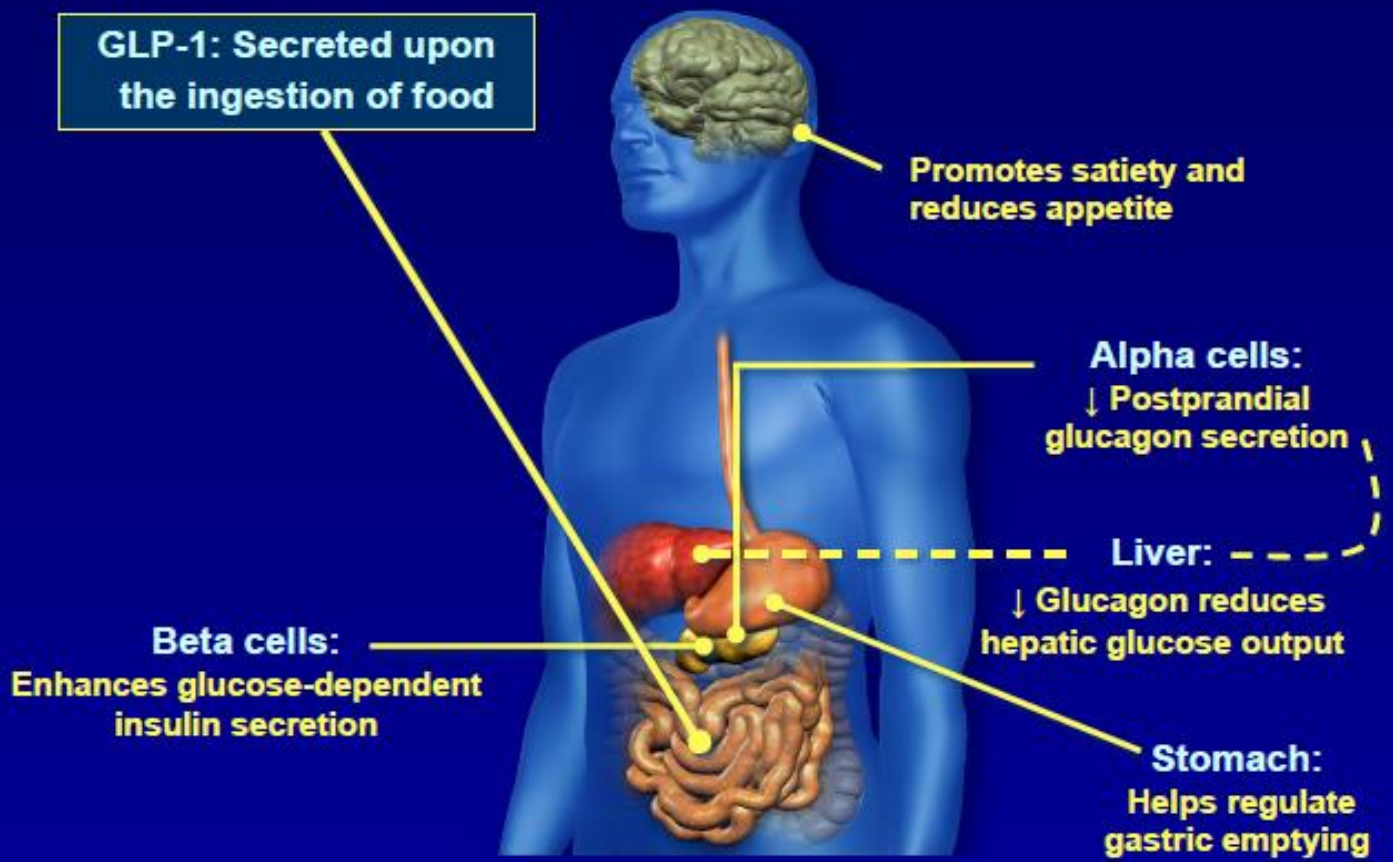
GHRELIN - a "hunger" hormone

- Ghrelin is produced mainly in the stomach (gastric fundus)
- Ghrelin enhances appetite and food intake, and decreases insulin sensitivity
- Plasma levels of ghrelin are suppressed after a meal
- Plasma levels of ghrelin increase after diet-induced weight loss
- Increases levels of counterregulatory hormones: GH, cortisol and epinephrine

Peptide YY (PYY) - a "satiety" hormone

- PYY is produced in the ileum and colon and is secreted postprandially in proportion to the calorie content of a meal
- Cleavage of PYY(1-36) produces PYY(3-36) which acts as a satiety factor, delays gastric emptying and improves insulin sensitivity

GLP-1 Modulates Numerous Functions in Humans



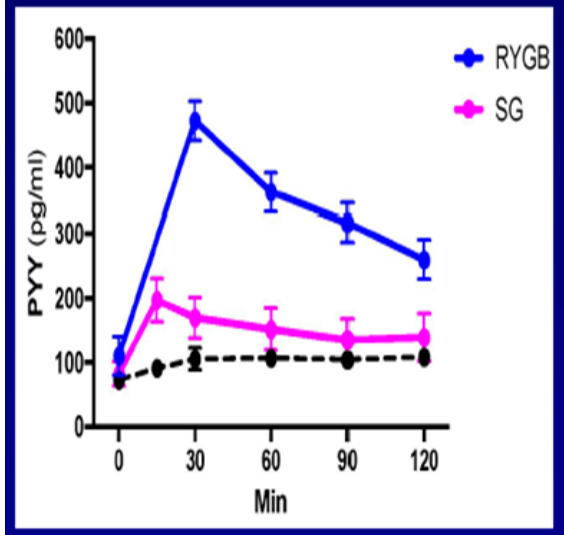
Data from Flint A, et al. *J Clin Invest.* 1998;101:515-520; Data from Larsson H, et al. *Acta Physiol Scand.* 1997;160:413-422
Data from Nauck MA, et al. *Diabetologia.* 1996;39:1546-1553; Data from Drucker DJ. *Diabetes.* 1998;47:159-169

Glucagon Like Peptide-1

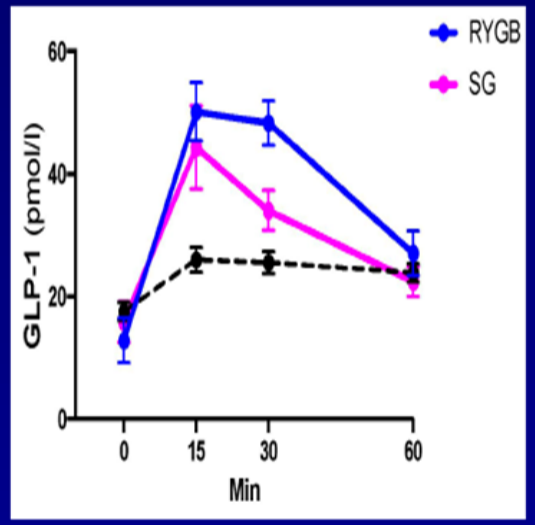
- 30 amino acid peptide hormone
- Secreted in the intestinal epithelial endocrine cells, in response to nutrient ingestion, particularly carbohydrate diet
- Secreted by distal part of small intestine and colon (L calle), pancreas and CNS
- Produced by differential processing of proglucagon
- Stimulates insulin secretion
- One of the incretin hormones along with Gastric Inhibitory Peptide

SG vs RYGB - Year 1

PYY

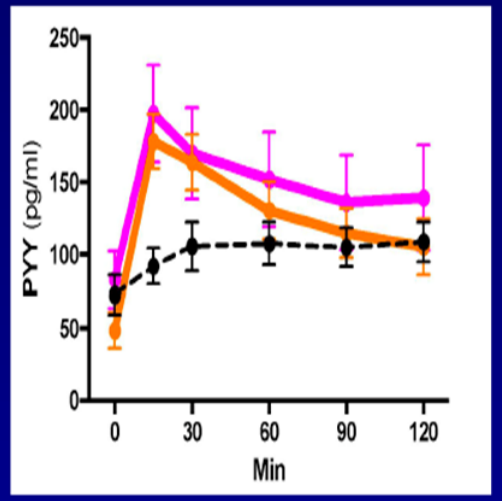


GLP-1

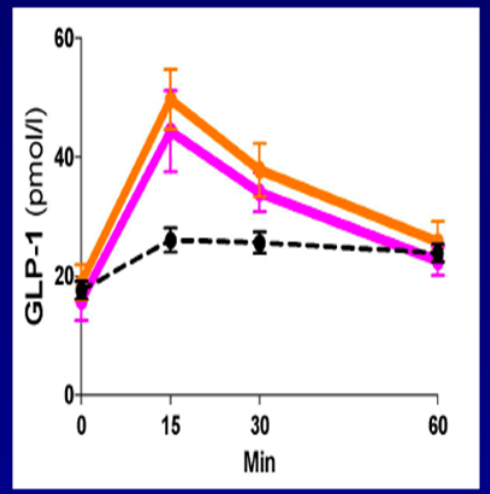


Sleeve Gastrectomy

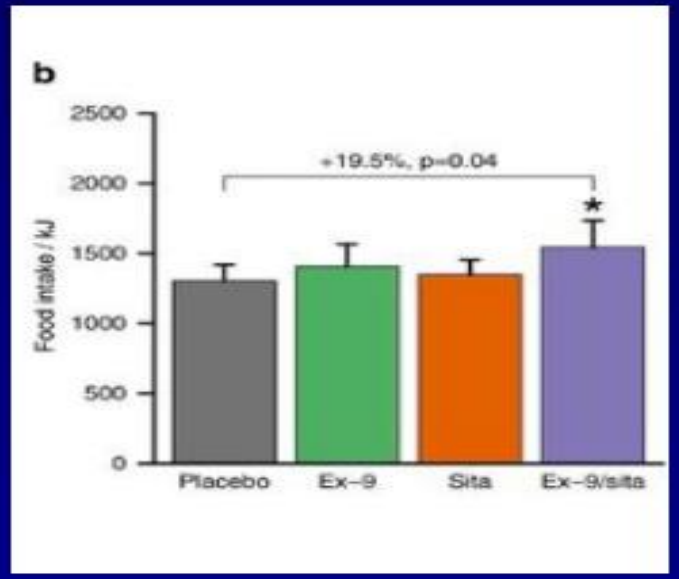
PYY



GLP-1

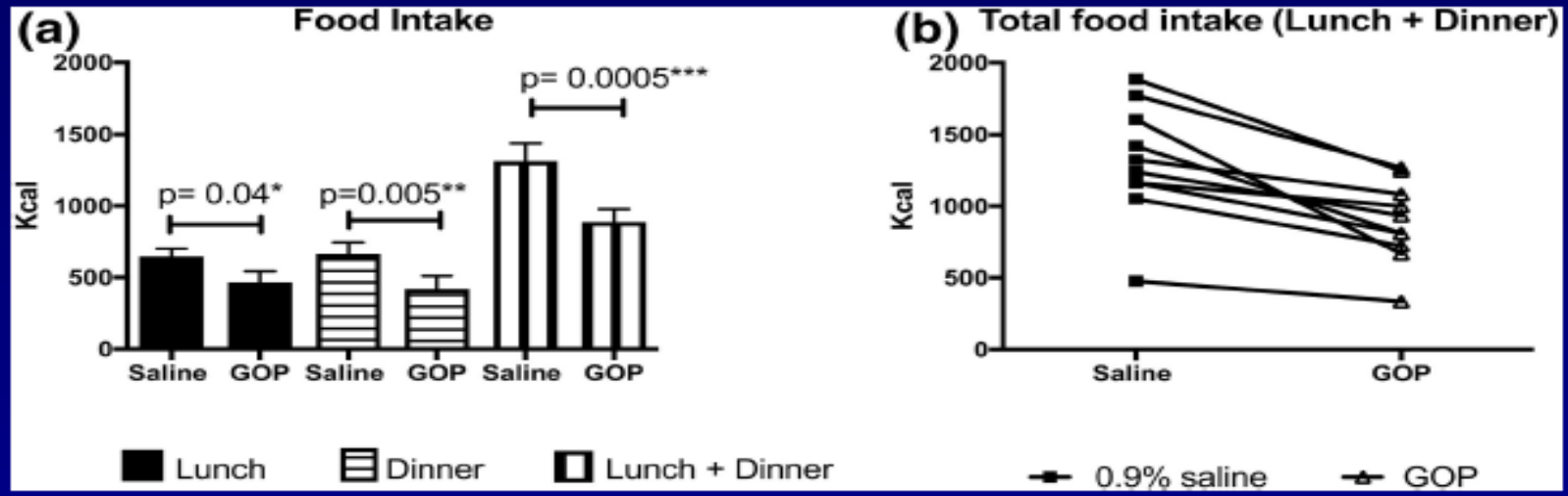


Blockade of GLP-1 and PYY_{3-36} actions after RYGB results in 20% increase in food intake

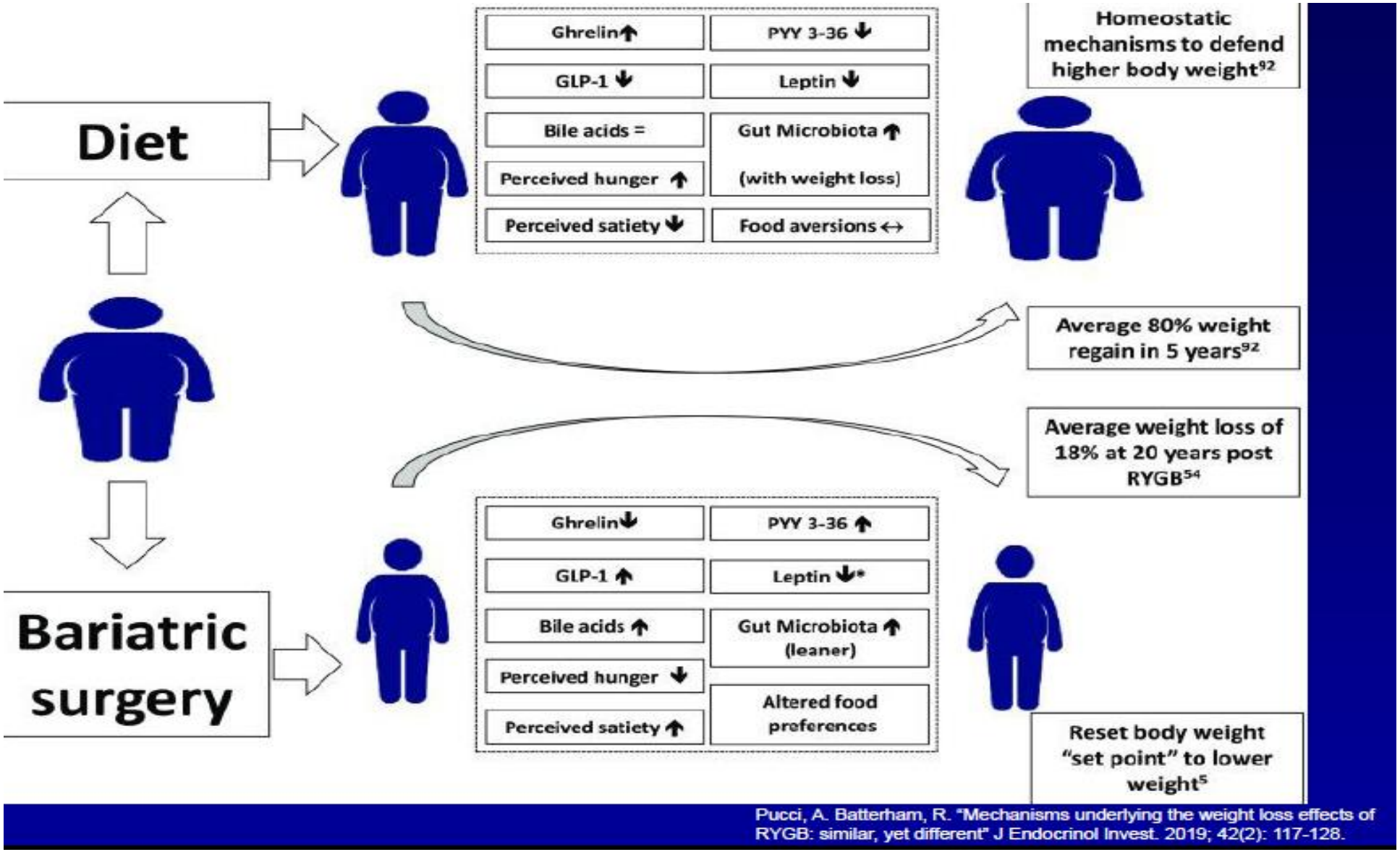


Svane et al International Journal of Obesity volume40, pages1699–1706 (2016)

Subcutaneous infusion of GLP-1, Oxyntomodulin and PYY to achieve postprandial levels after RYGB causes a 32% reduction in food intake

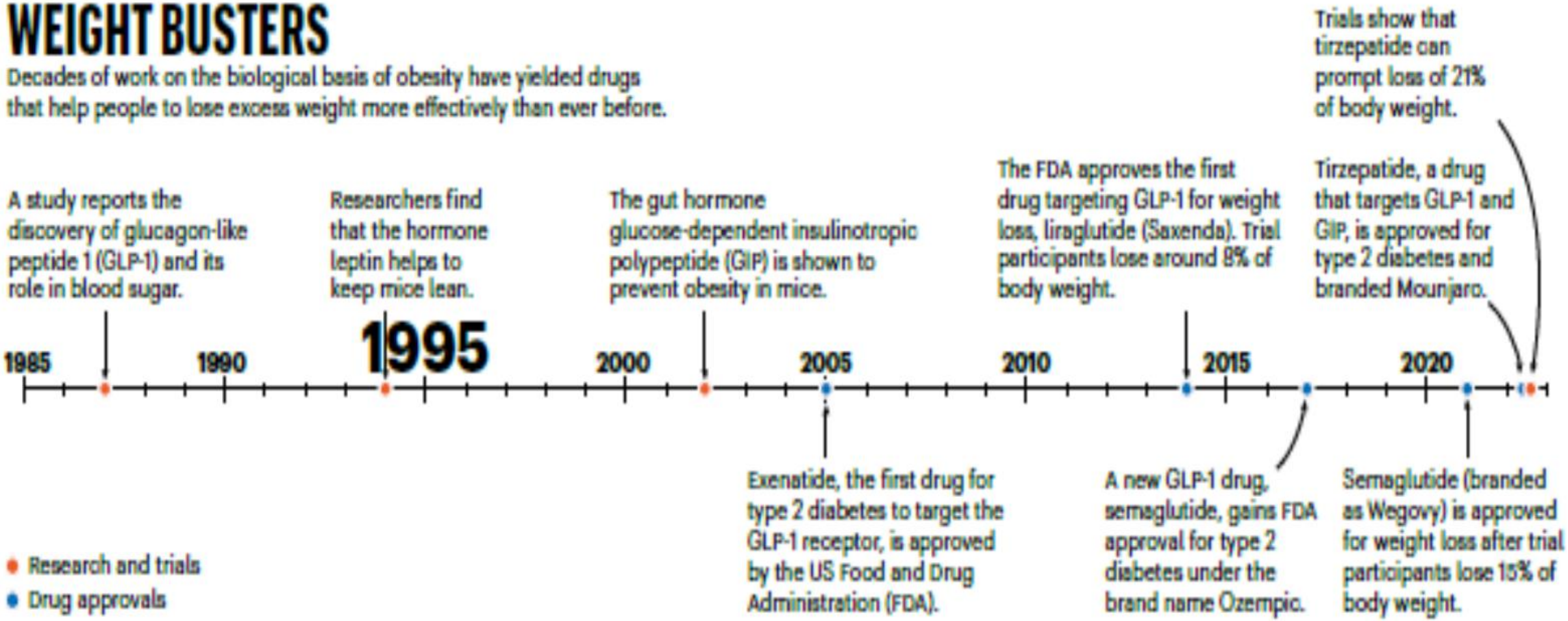


Tan et al, The Journal of Clinical Endocrinology & Metabolism, Volume 102, Issue 7, 1 July 2017, Pages 2364–2372.


Diet
Ghrelin ↑
PYY 3-36 ↓
GLP-1 ↓
Leptin ↓
Bile acids =
Gut Microbiota ↑
(with weight loss)
Perceived hunger ↑
Perceived satiety ↓
Food aversions ↔
Homeostatic mechanisms to defend higher body weight[92]
Average 80% weight regain in 5 years[92]
Average weight loss of 18% at 20 years post RYGB[54]
Bariatric surgery
Ghrelin ↓
PYY 3-36 ↑
GLP-1 ↑
Leptin ↓*
Bile acids ↑
Gut Microbiota ↑ (leaner)
Perceived hunger ↓
Perceived satiety ↑
Altered food preferences
Reset body weight "set point" to lower weight[5]
Pucci, A. Batterham, R. "Mechanisms underlying the weight loss effects of RYGB: similar, yet different" J Endocrinol Invest. 2019; 42(2): 117-128.

WEIGHT BUSTERS

Decades of work on the biological basis of obesity have yielded drugs that help people to lose excess weight more effectively than ever before.



SEMAGLUTIDES

- GLP-1 analog that has 94% sequence homology with human GLP-1
- Promotes insulin secretion from beta cells and reduces glucagon secretion
- Very long half life (155-184 hours) compared to human analog (102 mins)
- Reduces GI motility-nausea and bloating
- Both oral and subcutaneous doses reduce blood glucose and improve lipid metabolism

JAMA. 2017;318(15):1460-1470

Diabetes Obes Metab. 2018;20:610–619.

Semaglutide and Metabolic Health

- Produce sustained, clinically significant weight loss in patients with obesity
- Improves Metabolic Health
  - Reduce HbA1C levels by 1-8% after 32 weeks treatment
  - Reduction in LDL cholesterol, triglycerides
  - Improves physical activity
- Fasting and postprandial PYY responses were significantly lower with semaglutide vs placebo
- Tachyphylaxis at the level of vagal nerve activation

Diabetes Obes Metab. 2018 Mar; 20(3): 610–619. Acta Diabetol. 2022; 59(10): 1287–1294. **N Engl J Med 2021;384:989**

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THE OFFICIAL JOURNAL OF THE ANESTHESIA PATIENT SAFETY FOUNDATION

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Are Serious Anesthesia Risks of Semaglutide and Other GLP-1 Agonists Under-Recognized?

Case Reports of Retained Solid Gastric Contents in Patients Undergoing Anesthesia

by William Brian Beam, MD, and Lindsay R. Hunter Guevara, MD

INTRODUCTION

Glucagon-like peptide (GLP-1) receptor agonists are an emerging and increasingly popular class of medications used for the treatment of type 2 diabetes mellitus and, more recently, obesity. Since the expansion of approved uses to include weight loss, these medications have become increasingly popular. One mechanism of action of GLP-1 agonists is delayed gastric emptying.[1] We describe two cases of patients taking GLP-1 receptor agonists that were found to have high volumes of complex gastric contents despite appropriate fasting per American Society of Anesthesiologists (ASA) practice guidelines for preoperative fasting.[2] With the use of GLP-1 receptor agonists becoming increasingly more common, anesthesia professionals need to be aware of these

medications and the potential risks they pose to patients receiving anesthesia.

CASE 1

A 60-year-old female presented for magnetic resonance imaging with sedation for claustrophobia. She had a history of hypertension and was overweight (body mass index [BMI] 28 kg/m^2). The month prior, she started *semaglutide (Ozempic, Novo Nordisk, Plainsboro, NJ)* for weight loss (last dose 7 days prior to presentation). Despite fasting from solid food for more than 18 hours prior to evaluation, she described feeling "full." A point-of-care gastric ultrasound was performed, which revealed solid gastric contents. The decision was made to cancel her imaging for fear of high risk of aspiration during the delivery of anesthesia.

CASE 2

A 50-year-old female with past medical history of class 2 obesity (BMI 37.7 kg/m^2), type 2 diabetes, hypertension, and obstructive sleep apnea was scheduled to undergo a robotic-assisted hysterectomy for endometrial hyperplasia. Of note, she previously had gastroesophageal reflux disease, but these symptoms had resolved since she started *tirzepatide (Mounjaro, Eli Lilly, Indianapolis, IN) 12.5 mg/0.5 mL pen injector injection (last dose 2 days before surgery).*

See "GLP-1 Agonist Aspiration Risk," Page 69

Consensus Recommendations for the Safe Conduct

GLP-1 Agonists and Aspiration Risk

From "GLP-1 Agonist Aspiration Risk," Page 67

Her other medications included: metformin, hydrochlorothiazide, pregabalin, oxycodone, 5 mg as needed (intermittent use with last dose the day prior to surgery), and sertraline. She had been fasting since the night before surgery.

Anesthesia proceeded with an uneventful induction of general anesthesia and intubation. After intubation, an orogastric tube was placed and gastric contents (Figure 1) were suctioned.

The case was uncomplicated from a surgical perspective. At case completion, the patient was transferred to the transport cart and sat up in anticipation of emergence. Shortly before she was ready for extubation, she developed large volume emesis of particulate matter that was consistent with what she reported eating several days prior to surgery (Figure 2). Fortunately, the endotracheal tube was still in place and her airway remained protected. Once emesis was cleared, she was uneventfully extubated. She was closely observed in the PACU and did not have evidence to suggest gastropulmonary aspiration and was therefore discharged home later that day.

DISCUSSION

GLP-1 receptor agonists are an increasingly popular class of medications being prescribed to patients. These medications have been described as a "breakthrough" for weight loss. The GLP-1 receptor is expressed in a diverse range of organ systems including gastrointestinal (GI) tract, pancreas, heart, liver, and brain. Stimulation of this receptor leads to weight loss, improved glycemic control in diabetic patients, and improved cardiac and renal outcomes. The primary mechanism of action is related to both activation of vagal afferent nerves innervating the stomach as well as direct binding to GLP-1 receptors on gastric mucosal cells leading to delayed gastric emptying.[1] For diabetics, weight

Table 1: Common GLP-1 Agonists.[16,17]

	GLP-1 Agonists	Clinical Dosing	Pharmacokinetics HALF-LIFE	Pharmacokinetics ELIMINATION	Special Considerations
1st Generation	**Exanetide** (Byetta®, Bydureon®)	SQ, twice daily (IR), weekly (ER), uptitrated	3 hours	Renal	Associated with immune-mediated thrombocytopenia
1st Generation	**Lixisenatide** (Adlyxin®)	SQ, daily, uptitrated	3 hours	Renal	No longer available in United States
2nd Generation	**Semaglutide** (Wegovy®, Ozempic®) (Rybelsis®)	SQ, weekly, uptitrated Oral, daily, uptitrated	7 days	Renal	Approved (SQ formulation only) for weight loss
2nd Generation	**Liraglutide** (Saxenda®, Victoza®)	SQ, daily uptitrated	12.5 hours	Renal	Approved for weight loss
2nd Generation	**Dulaglutide** (Trulicity®)	SQ, weekly	4.5 days	Renal	
	GLP-1/GIP Agonist				
	Tirzepatide (Mounjaro®)	SQ, weekly	5 days	Renal	Approved for weight loss

SQ = Subcutaneous.

Figure 1 : Depicts gastric contents in a patient on a GLP-1 agonist, who appropriately adhered to ASA fasting guidelines.

Figure 2 : Depicts large volume emesis of particulate matter in a patient on a GLP-1 agonist that was consistent with what the patient reported eating several days prior to surgery.

cystitis, have also been described. Although rare, anaphylactic and angioedema reactions have been described.[7]

Despite the benefits of the class of medications on obese and diabetic patients, there are

contents.[10,11] For this reason, recognition of patient populations at elevated risk for increased gastric volume is key to delivering a safe anesthetic (Table 2).

Although it was avoided in these cases, the

EDITORIAL

Perioperative management of long-acting glucagon-like peptide-1 (GLP-1) receptor agonists: concerns for delayed gastric emptying and pulmonary aspiration

Mark L. van Zuylen[1,2], Sarah E. Siegelaar[3,4], Mark P. Plummer[6], Adam M. Deane[5], Jeroen Hermanides[1] and Abraham H. Hulst[1,4,*]

British Journal of Anaesthesia, 132 (4): 644–648 (2024)

June 29, 2023

American Society of Anesthesiologists Consensus-Based Guidance on Preoperative Management of Patients (Adults and Children) on Glucagon-Like Peptide-1 (GLP-1) Receptor Agonists

Girish P. Joshi, M.B.B.S., M.D., Basem B. Abdelmalak, M.D., Wade A. Weigel, M.D., Sulpicio G. Soriano, M.D., Monica W. Harbell, M.D., Catherine I. Kuo, M.D., Paul A. Stricker, M.D., Karen B. Domino, M.D., M.P.H., American Society of Anesthesiologists (ASA) Task Force on Preoperative Fasting

DAY(S) PRIOR TO THE PROCEDURE:

- Irrespective of indication (diabetes or weight loss), for patients on weekly dosing consider holding GLP-1 agonists a week prior to the procedure/surgery. For patients on daily dosing consider holding GLP-1 agonists on the day of the procedure/surgery.
- If GLP-1 agonists prescribed for diabetes management are held for longer than the dosing schedule, consider consulting an endocrinologist for bridging the antidiabetic therapy to avoid hyperglycemia.

DAY OF THE PROCEDURE:

- If GI symptoms such as severe nausea/vomiting/retching, abdominal bloating, or abdominal pain are present, consider delaying elective procedure, and discuss the concerns of potential risk of regurgitation and pulmonary aspiration of gastric contents with the proceduralist/surgeon and the patient.
- If the patient has no GI symptoms, and the GLP-1 agonists have been held as advised, proceed as usual.
- If the patient has no GI symptoms, but the GLP-1 agonists were not held as advised, proceed with "full stomach" precautions or consider evaluating gastric volume by ultrasound, if possible, and if proficient with the technique. If the stomach is empty, proceed as usual. If the stomach is full or if gastric ultrasound is inconclusive or not possible, consider delaying the procedure or treat the patient as "full stomach" and manage accordingly. Discuss the concerns of potential risk of regurgitation and pulmonary aspiration of gastric contents with the proceduralist/surgeon and the

ORIGINAL ARTICLE

Effects of Semaglutide on Chronic Kidney Disease in Patients with Type 2 Diabetes

Authors: Vlado Perkovic, M.B., B.S., Ph.D., Katherine R. Tuttle, M.D., Peter Rossing, M.D., D.M.Sc., Kenneth W. Mahaffey, M.D., Johannes F.E. Mann, M.D., George Bakris, M.D., Florian M.M. Baeres, M.D., Thomas Idorn, M.D., Ph.D., Heidrun Bosch-Traberg, M.D., Nanna Leonora Lausvig, M.Sc., and Richard Pratley, M.D., for the FLOW Trial Committees and Investigators* Author Info & Affiliations

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The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 DECEMBER 14, 2023 VOL. 389 NO. 24

Semaglutide and Cardiovascular Outcomes in Obesity without Diabetes

Original Investigation | Nutrition, Obesity, and Exercise

Weight Loss Outcomes Associated With Semaglutide Treatment for Patients With Overweight or Obesity

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 SEPTEMBER 21, 2023 VOL. 389 NO. 12

Semaglutide in Patients with Heart Failure with Preserved Ejection Fraction and Obesity

M.N. Kosiborod, S.Z. Abildstrøm, B.A. Borlaug, J. Butler, S. Rasmussen, M. Davies, G.K. Hovingh, D.W. Kitzman, M.L. Lindegaard, D.V. Møller, S.J. Shah, M.B. Treppendahl, S. Verma, W. Abhayaratna, F.Z. Ahmed, V. Chopra, J. Ezekowitz, M. Fu, H. Ito, M. Lelonek, V. Melenovsky, B. Merkely, J. Núñez, E. Perna, M. Schou, M. Senni, K. Sharma, P. Van der Meer, D. von Lewinski, D. Wolf, and M.C Petrie, for the STEP-HFpEF Trial Committees and Investigators*

Gastric Emptying and Obesity

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Division of Digestive Diseases and Nutrition, Departments of Medicine and Nuclear Medicine, University of Louisville School of Medicine and Veterans Administration Medical Center, Louisville, Kentucky

Abnormal gastric emptying in the obese has been previously suggested. To explore this concept, we studied a group of 77 subjects composed of 46 obese and 31 age-, sex-, and race-matched nonobese individuals. All of the subjects underwent quantitative fluid/solid gastric emptying assays utilizing a dual radionuclide technique. For the solid phase, obese subjects were found to have a more rapid emptying rate than nonobese subjects ($p < 0.05$). Obese men were found to empty much more rapidly than their nonobese counterparts ($p < 0.01$). In 4 obese subjects whose weight loss was to within 10% of their ideal weight, repeat gastric emptying studies revealed no change in liquid or solid emptying rates. The elimination patterns of gastric emptying for liquids and solids were identical to those described previously, and did not differ between the obese and nonobese groups. No correlation between body surface area and gastric emptying rates of solids or liquids could be found. The rate of solid gastric emptying in the obese subjects is abnormally rapid. No clear-cut explanation for this finding yet exists.

Obesity is a common malady that influences multiple physiological functions. The underlying etiology for this disorder remains obscure in all but rare cases of primary endocrine anomalies.

Several investigators have described alterations in gastric emptying in relation to food composition, body surface area, and obesity (1–7). Hunt and Stubbs (1) demonstrated an inverse relationship between the rate of gastric emptying, and the caloric density of the ingested meal. Gastric emptying was delayed by increasing the amount of protein in the test meal (2). In addition, Hunt (3,4) noted that obese subjects selected a more energy dense diet than did normal subjects. Fara's work (5) demonstrated that the infusion of lipid into the duodena of cats decreased gastric motility. Johansson et al. (6) found that nonobese subjects transferred calories from the stomach to the duodenum at a rate directly proportional to their body weight. In normal subjects, Lavigne (7) noted an inverse linear relationship between the body surface area and the rate of solid gastric emptying. Studies in morbidly obese patients were not performed. Thus, possible interrelationships between the caloric density and constituents of ingested meals, gastric emptying rates, and obesity have been elucidated.

The purpose of this investigation was to determine whether morbidly obese subjects had significantly different rates of solid and liquid gastric emptying than age-, sex-, and race-matched nonobese controls. Also, the tenet of gastric emptying as a variable of body surface area, as noted by Lavigne et al., was explored. Further, the measurement of gastric emptying rates after weight reduction was studied to ascertain whether or not a primary or secondary relationship between altered gastric emptying and obesity existed. If gastric emptying changed after weight loss, then alterations in gastric emptying might be due to obesity itself, thus indicating a secondary disorder. On the other hand, if rapid emptying was found to exist in the obese population with no change after weight loss, it might be considered as a potential primary causative factor in the genesis of the condition.

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Methods

Patient Selection

Forty-six obese subjects [mean weight 249 lbs. (range 167–461 lbs), mean age 39.5 yr (range 20–62 yr), mean height 68 in. (range 59–84 in.)] were selected from

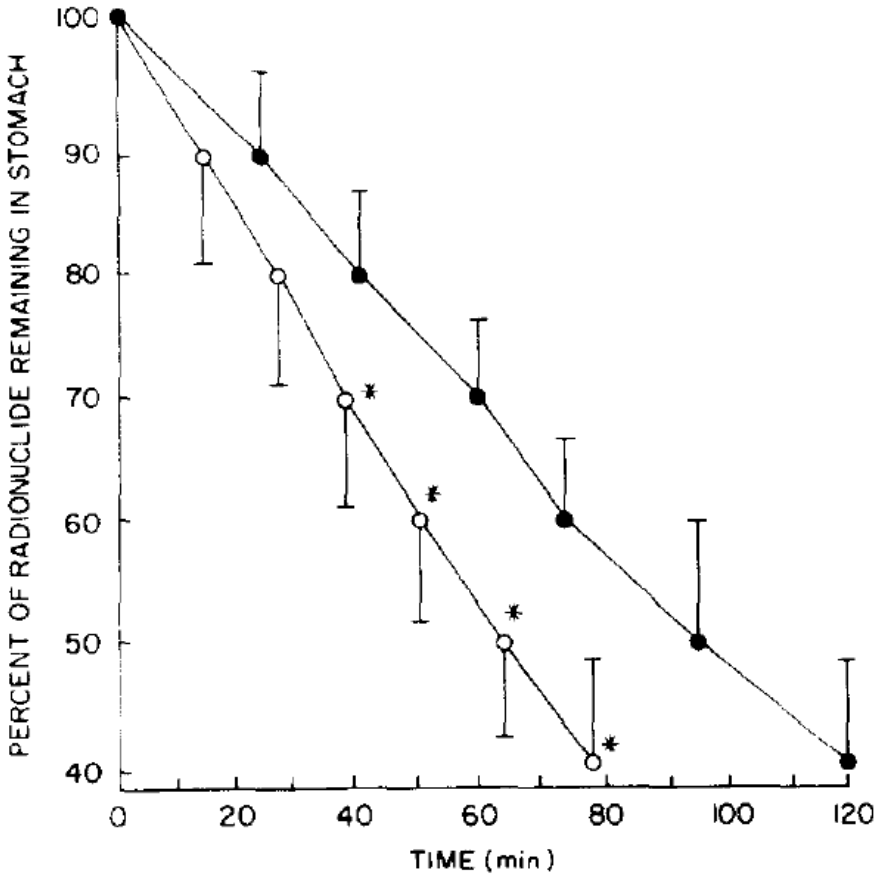

Figure 1. Gastric emptying of a solid test meal in obese (*open circles*) (n = 46) and nonobese (*closed circles*) subjects (n = 31). Statistical significance ($p < 0.05$) between the

Gastroenterology. 1983 Apr;84(4):747-51.

obese and lean surgical patients

A Comparison of the Volume and pH of Gastric Contents of Obese and Lean Surgical Patients

Ronald L. Harter, MD, William B. Kelly, MD, Matthew G. Kramer, MD, Cara E. Perez, BS, and Roger R. Dzwonczyk, MS

Department of Anesthesiology, Ohio State University Hospitals, Columbus, Ohio

Obese surgical patients are typically considered to be more likely than lean patients to possess high-volume and low-pH (HVLP) gastric contents after a standard preoperative fast, based on a study of a population predominately consisting of patients receiving intramuscular preoperative sedation. We revisited this issue in a study population of 256 fasted surgical patients, of which 232 received no preoperative antacid or gastric prokinetic drug. Immediately after endotracheal intubation, an 18-French sump tube was placed, and gastric contents were withdrawn. Subjects' gastric contents were defined as HVLP if they exhibited a combination of a volume >25 mL and a pH <2.5. Obesity was defined as a body mass index >30. Among nonmedicated obese patients, the proportion with HVLP gastric contents was 20 of 75 (26.6%). The proportion of lean patients with HVLP gastric contents was 66 of 157 (42.0%). The difference between the HVLP proportions for these two groups was found to be significant ($P < 0.05$) using χ^2 analysis. Obesity seems to be associated with a significantly decreased risk of HVLP gastric contents among surgical patients with no history of gastroesophageal pathology after a normal interval of preoperative fasting. **Implications:** Previous studies have shown that obese surgical patients have a greater volume of acidic stomach contents than lean patients, despite a routine preoperative fast. We have reexamined this issue and found that among otherwise healthy, fasted, obese surgical patients, there is a lower incidence of combined high-volume, low-pH stomach contents compared with lean patients.

(Anesth Analg 1998;86:147–52)

Pulmonary aspiration of gastric contents during the conduct of anesthesia is a rare event, occurring in approximately 1 in every 3,000 general anesthetics (1). When aspiration does occur, however, significant morbidity can result. The mortality rate for pulmonary aspiration is 1 in 71,000 general anesthetics (1). A prospective, randomized, controlled trial concerning factors associated with pulmonary aspiration would require a prohibitively large sample size to have adequate power to detect statistically significant differences in outcome. Thus, alternative end points presumed to be associated with the incidence of pulmonary aspiration have been more extensively studied. For example, high gastric content volume and low gastric content pH have been shown in various animal models to produce significant pulmonary injury when pulmonary aspiration of gastric contents occurs (2,3).

The precise level of gastric content pH and volume at which an individual is considered to be at a significant risk of pulmonary injury is controversial. However, the most often reported values are for a pH <2.5 combined with a volume >25 mL. Although there are several methods for the collection of gastric contents, blindly withdrawing them with a sump tube is a method that is often used, and one that represents fairly accurately the gastric milieu at any given time (4,5).

Defining specific surgical populations that present an increased risk of pulmonary aspiration is of obvious benefit. Accurately identifying and effectively treating those patients that present an increased risk of pulmonary aspiration should result in reducing the incidence and severity of aspiration while minimizing the unnecessary administration of antacids and/or gastric prokinetic drugs to those patients without increased aspiration risk. Obese patients have been considered to present an increased risk of perioperative

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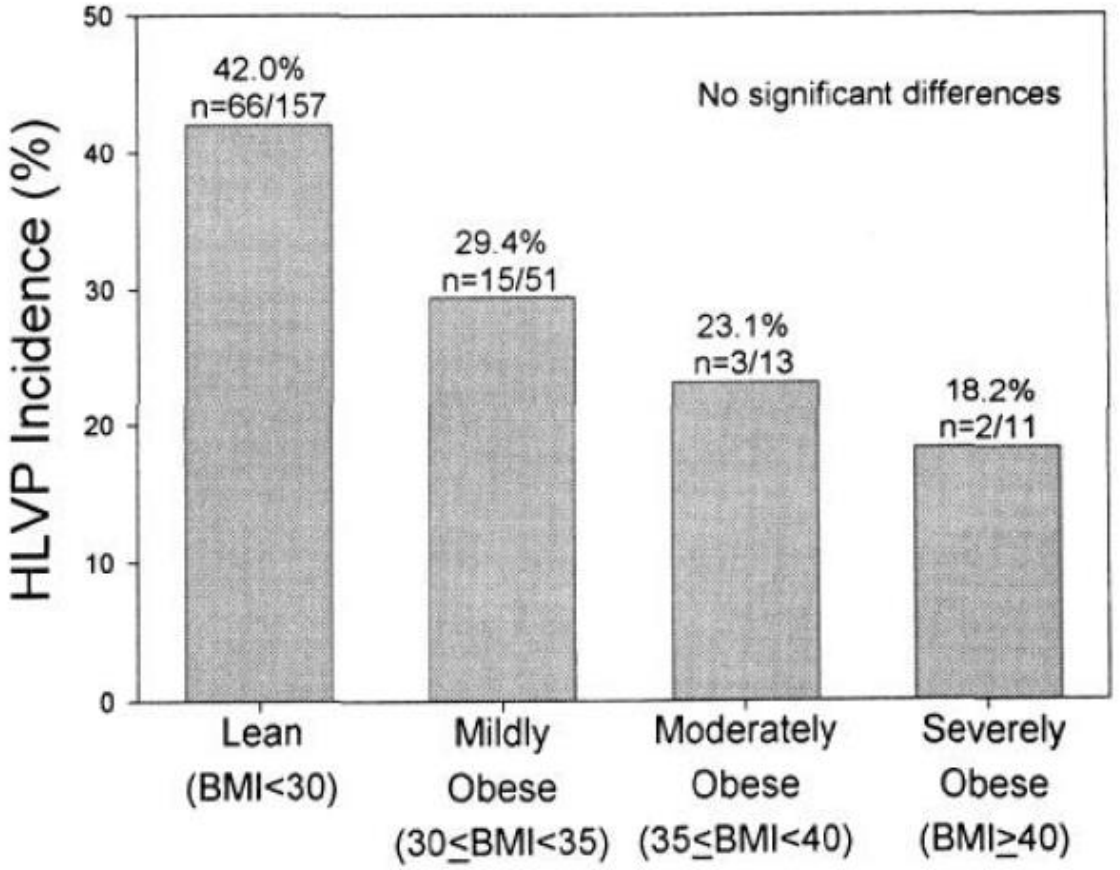

Figure 3. Incidence of high-volume (>25 mL), low-pH (<2.5) (HVLP) gastric content as a function of body mass index (BMI). There were no significant differences ($P > 0.05$) among the groups.

Anesth Analg. 1998 Jan;86(1):147-52.

ERABS 2016 vs 2021

World J Surg (2016) 40:2065–2083
DOI 10.1007/s00268-016-3492-3

SCIENTIFIC REVIEW

Guidelines for Perioperative Care in Bariatric Surgery: Enhanced Recovery After Surgery (ERAS) Society Recommendations

A. Thorell[1] · A. D. MacCormick[2,3] · S. Awad[4,5] · N. Reynolds[4] · D. Roulin[6] · N. Demartines[6] · M. Vignaud[7] · A. Alvarez[8] · P. M. Singh[9] · D. N. Lobo[10]

Published online: 4 March 2016

Abstract

Background During the last two decades, an increasing number of bariatric surgical procedures have been performed worldwide. There is no consensus regarding optimal perioperative care in bariatric surgery. This review aims to present such a consensus and to provide graded recommendations for elements in an evidence-based "enhanced" perioperative protocol.

Methods The English-language literature between January 1966 and January 2015 was searched, with particular attention paid to meta-analyses, randomised controlled trials and large prospective cohort studies. Selected studies were examined, reviewed and graded. After critical appraisal of these studies, the group of authors reached a consensus recommendation.

Results Although for some elements, recommendations are extrapolated from non-bariatric settings (mainly colorectal), most recommendations are based on good-quality trials or meta-analyses of good-quality trials.

Conclusions A comprehensive evidence-based consensus was reached and is presented in this review by the enhanced recovery after surgery (ERAS) Society. The guidelines were endorsed by the International Association for Surgical Metabolism and Nutrition (IASMEN) and based on the evidence available in the literature for each of the elements of the multimodal perioperative care pathway for patients undergoing bariatric surgery.

✉ A. Thorell

World J Surg
https://doi.org/10.1007/s00268-021-06394-9

SCIENTIFIC REVIEW

Guidelines for Perioperative Care in Bariatric Surgery: Enhanced Recovery After Surgery (ERAS) Society Recommendations: A 2021 Update

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Accepted: 24 October 2021

Abstract

Background This is the second updated Enhanced Recovery After Surgery (ERAS®) Society guideline, presenting a consensus for optimal perioperative care in bariatric surgery and providing recommendations for each ERAS item within the ERAS® protocol.

Methods A principal literature search was performed utilizing the Pubmed, EMBASE, Cochrane databases and ClinicalTrials.gov through December 2020, with particular attention paid to meta-analyses, randomized controlled trials and large prospective cohort studies. Selected studies were examined, reviewed and graded according to the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) system. After critical appraisal of these studies, the group of authors reached consensus regarding recommendations.

Results The quality of evidence for many ERAS interventions remains relatively low in a bariatric setting and evidence-based practices may need to be extrapolated from other surgeries.

Conclusion A comprehensive, updated evidence-based consensus was reached and is presented in this review by the ERAS® Society.

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SCIENTIFIC REVIEW

Guidelines for Perioperative Care in Bariatric Surgery: Enhanced Recovery After Surgery (ERAS) Society Recommendations

A. Thorell[1] · A. D. MacCormick[2,3] · S. Awad[4,5] · N. Reynolds[4] · D. Roulin[6] · N. Demartines[6] · M. Vignaud[7] · A. Alvarez[8] · P. M. Singh[9] · D. N. Lobo[10]

Preoperative fasting	*Obese patients may have clear fluids up to 2 h and solids up to 6 h prior to induction of anaesthesia. Further data are necessary in diabetic patients with autonomic neuropathy due to potential risk of aspiration*	*Non-diabetic obese patients*: High	Strong
		Diabetic patients without Autonomic neuropathy: Moderate	Weak
		Diabetic patients with autonomic neuropathy: Low	Weak

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ELSEVIER

SURGERY FOR OBESITY AND RELATED DISEASES

Surgery for Obesity and Related Diseases 9 (2013) 714–717

Original article

Gastric emptying is not prolonged in obese patients

Vered Buchholz, M.D.[a], Haim Berkenstadt, M.D.[b], David Goitein, M.D.[a], Ram Dickman, M.D.[c], Hanna Bernstine, M.D.[d], Moshe Rubin, M.D.[a,*]

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Received December 24, 2011; accepted March 2

Abstract

Background: Obesity is associated with a poor anesthetic risk, aspiration rates. A greater gastric residue and lower stomach pl relationship of obesity to gastric emptying is ill-defined. with contr similar, and longer times compared with nonobese subjects. The a compare gastric emptying in obese and nonobese subjects at a univ
Methods: A total of 19 obese (body mass index [BMI] >40 kg/m^2) an subjects underwent a standardized scintigraphic gastric emptying stu standard semisolid, technetium-99m-labeled meal. Images were acquired i after meal completion. The interval to evacuate one half of the counts m retention (the percentage of counts in stomach at each measurement point)
Results: The mean age and BMI was 35 years and 45 kg/m^2 in the ob in the nonobese group, respectively. No differences were found be gastric emptying. Regression analysis showed no statistical associatio emptying, including multivariate analysis, considering BMI, age, a
Conclusion: A scintigraphy test of a labeled meal was used to eval and nonobese subjects. In accordance with other published data, no s between the 2 groups. The anesthetic risks in the obese should be delayed gastric emptying (i.e., anatomic variation, increased rates of Obes Relat Dis 2013;9:714–717.) © 2013 American Society for M All rights reserved.

Keywords: Gastric emptying; Morbid obesity; Bariatric surgery

Obesity, resulting in delayed gastric emptying, is believed to be a risk factor for aspiration during anesthesia induction. The pulmonary aspiration of gastric content during general anesthesia is a rare event, with possible life-threatening consequences [1]. However, contradictory information linking the gastric emptying rate to body weight has been reported. An

strated that the gastric content in the fasting state was both more abundant and more acidic in obese than in lean patients. Juvin et al. [3], using endoscopy and aspiration of gastric contents, demonstrated identical gastric content volumes in fasting obese and lean subjects, with a lower pH in the obese subjects. An evaluation of gastric emptying in obese subjects has been

Table 2
Gastric emptying scintigraphy results

Variable	Obese	Nonobese	*P* value
Half time* (min)	65.1 ± 23.1	66.2 ± 21.9	.88
Retention† 1 h (%)	48 ± 16.8	47.1 ± 18.7	.89
Retention 2 h (%)	17.6 ± 13.9	14.9 ± 12.3	.44
Retention 4 h (%)	1.7 ± 1.5	1.1 ± .9	.06

* Interval between meal completion and point at which one half of the meal (radioactivity counts) had left the stomach.

† Percentage remaining in stomach at each measurement point.

Surg Obes Relat Dis. 2013 Sep-Oct;9(5):714-7.

General Anesthesia

Drinking 300 mL of clear fluid two hours before surgery has no effect on gastric fluid volume and pH in fasting and non-fasting obese patients

[Le fait de boire 300 mL de liquide clair deux heures avant d'être opéré n'a pas d'effet sur le volume de liquide ni sur le pH gastriques chez des patients obèses à jeun ou non]

J. Roger Maltby MB FRCA FRCPC,* Saul Pytka MD FRCPC,* Neil C. Watson MB FRCPC,*
Robert A. McTaggart Cowan MD FRCPC,* Gordon H. Fick BSc MSc PhD†

Purpose: To determine whether, in obese [body mass index (BMI) > 30 kg·m^2] patients, oral intake of 300 mL clear liquid two hours before elective surgery affects the volume and pH of gastric contents at induction of anesthesia.

Methods: A single-blind, randomized study of 126 adult patients, age ≥ 18 yr, ASA physical status I or II, BMI > 30 kg·m^2 who were scheduled for elective surgery under general anesthesia. Patients were excluded if they had diabetes mellitus, symptoms of gastroesophageal reflux, or had taken medication within 24 hr that affects gastric secretion, gastric fluid pH or gastric emptying. All patients fasted from midnight and were randomly assigned to fasting or fluid group. Two hours before their scheduled time of surgery, all patients drank 10 mL of water containing phenol red 50 mg. Those in the fluid group followed with 300 mL clear liquid of their choice. Immediately following induction of general anesthesia and tracheal intubation, gastric contents were aspirated through a multiorifice Salem sump tube. The fluid volume, pH and phenol red concentration were recorded.

Results: Median (range) values in fasting *vs* fluid groups were: gastric fluid volume 26 (3–107) mL *vs* 30 (3–187) mL, pH 1.78 (1.31–7.08) *vs* 1.77 (1.27–7.34) and phenol red retrieval 0.1 (0–30)% *vs* 0.2 (0–15)%. Differences between groups were not statistically significant.

Conclusion: Obese patients without comorbid conditions should follow the same fasting guidelines as non-obese patients and be allowed to drink clear liquid until two hours before elective surgery, inasmuch as obesity *per se* is not considered a risk factor for pulmonary aspiration.

Objectif : *Déterminer si, chez des patients obèses [indice de masse corporelle (IMC) > 30 kg·m^2], la prise orale de 300 mL de liquide clair deux heures avant de subir une opération réglée a un effet sur le volume et le pH du contenu gastrique lors de l'induction anesthésique.*

Méthode : *Une étude randomisée, à simple insu, a été menée auprès de 126 patients adultes, ≥ 18 ans, d'état physique ASA I ou II, d'IMC > 30 kg·m^2, devant subir une intervention chirurgicale réglée sous anesthésie générale. La présence de diabète, ou de symptômes de reflux gastro-œsophagien ou la prise de médicaments, dans les 24 h avant l'opération, pouvant affecter la sécrétion gastrique, le pH du liquide gastrique ou l'évacuation gastrique entraînaient l'exclusion du patient. Tous les patients, à jeun depuis minuit, ont été répartis en deux groupes : jeûne ou liquide. Deux heures avant l'heure prévue de l'opération, tous les patients ont bu 10 mL d'eau contenant 50 mg de rouge de phénol. Les patients du groupe «liquide» ont pris ensuite 300 mL d'un liquide clair de leur choix. Immédiatement après l'induction de l'anesthésie et l'intubation endotrachéale, le contenu gastrique a été aspiré au moyen d'une sonde multiorifice Salem. Le volume de liquide, le pH et les concentrations de rouge de phénol ont été notés.*

Résultats : *Les valeurs moyennes (étendue) du groupe de jeûne vs le groupe «liquide» ont été : volume de liquide gastrique 26 (3–107) mL vs 30 (3–187) mL, pH 1,78 (1,31–7,08) vs 1,77 (1,27–7,34) et repérage du rouge de phénol 0,1 (0–30) % vs 0,2 (0–15) %. Il n'y avait pas de différence intergroupe significative.*

Conclusion : *Les patients obèses, sans symptômes comorbides, devraient suivre les mêmes directives de jeûne que les patients non obèses. Ils peuvent boire un liquide clair jusqu'à deux heures avant une opération réglée, étant donné que l'obésité en elle-même n'est pas considérée comme un facteur de risque d'aspiration pulmonaire.*

TABLE II Residual gastric fluid volume, pH and phenol red dye

	Fasting $n = 65$	*Drinking* $n = 65$
Volume ($P = 0.46$)	26 (3-107)	30 (3-187)
pH ($P = 0.91$)	1.78 (1.31-7.08)	1.77 (1.27-7.34)
% ingested dye recovered	0.1 (0-30.45)	0.23 (0-14.64)
Patients (n) with 0 to 5% dye	60	55
Patients (n) with 5.1 to 10% dye	2	9
Patients (n) with >10% dye	3	1

Values are median (range).

Can J Anaesth. 2004 Feb;51(2):111-5.

Relationship Between Diabetic Autonomic Neuropathy and Gastric Contents

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Department of Anesthesiology and Pain Management, University of Texas Southwestern Medical School, Dallas, Texas

Delayed gastric emptying secondary to diabetic autonomic neuropathy (DAN) is a recognized risk factor for aspiration pneumonitis. The purpose of this study is to determine whether bedside autonomic function tests (AFTs) would predict gastric contents. Gastric volume and its pH were measured in 36 patients with diabetes mellitus (DM) and 15 nondiabetic patients at induction of general anesthesia for elective ambulatory surgery.

older and more obese than nondiabetics and those with DM more than 10 yr were more often DAN positive. Solid, undigested food particles were found more often in the gastric contents of DAN-positive patients compared to nondiabetics. Gastric liquid volume and pH were similar in diabetic patients (DAN positive and DAN negative) and nondiabetic controls. These results demonstrate that diagnosis of DAN by commonly used

Table 3. Presence of High Risk and Solid Particles

	Nondiabetics		DAN-negative		DAN-positive	
	$n = 15$	%	$n = 20$	%	$n = 16$	%
No. of patients with pH <2.5	13	87	15	75	9	56
No. of patients with volume >25 mL	9	60	12	60	6	38
No. of patients at risk (pH <2.5; volume >25 mL)	8	53	8	40	4	25
Solid particles	0	0	1	5	5	31*

DAN = diabetic autonomic neuropathy.
* $P < 0.05$ compared to nondiabetic groups.

P

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bility ... delayed gastric emptying is accepted as a risk factor in aspiration pneumonitis (1). We have witnessed a near-fatal aspiration pneumonitis in a diabetic patient scheduled for elective ophthalmic surgery under general anesthesia and questioned whether objective preoperative autonomic function tests (AFTs) could predict gastric retention

tify control patients of similar age, sex, weight, and surgical procedure as the diabetic patients. Fifty-one adult ASA grade I-III patients undergoing elective ambulatory surgery under general endotracheal anesthesia were enrolled in the study: 36 diabetic patients and 15 nondiabetic patients. Seventy-four percent of patients (38/51) underwent ophthalmologic surgery, mostly vitrectomy, and the remaining patients underwent procedures other than major abdominal operations. The predominance of ophthalmic cases is a result of two factors: patients with DM are more often found in the eye surgery room than in other rooms, and the

Accepted for publication January 19, 1994.
Address correspondence to Adolph H. Giesecke, MD, Department of Anesthesiology and Pain Management, University of Texas Southwestern Medical School, 5323 Harry Hines Boulevard, Dallas, TX 75235-9068.

Anesth Analg. 1994 May;78(5):943-7.

GUIDELINES

Perioperative fasting in adults and children: guidelines from the European Society of Anaesthesiology

Ian Smith, Peter Kranke, Isabelle Murat, Andrew Smith, Geraldine O'Sullivan, Eldar Søreide, Claudia Spies and Bas in't Veld

This guideline aims to provide an overview of the present knowledge on aspects of perioperative fasting with assessment of the quality of the evidence. A systematic search was conducted in electronic databases to identify trials published between 1950 and late 2009 concerned with preoperative fasting, early resumption of oral intake and the effects of oral carbohydrate mixtures on gastric emptying and postoperative recovery. One study on preoperative fasting which had not been included in previous reviews and a further 13 studies published since the most recent review were identified. The searches also identified 20 potentially relevant studies of oral carb intake. Publ evidence le Scottish Int assessing le used. The k should be e elective surg member of t milk added (up to about one fifth of the total volume) are allowed fluids. Solid food should be prohibited for 6 h before elective surgery in adults and children, although patients should not have their operation cancelled or delayed just because they are chewing gum, sucking a boiled sweet or smoking immediately prior to induction of anaesthesia. These recommendations also apply to patients with obesity, gastro-oesophageal reflux and diabetes and pregnant women not in labour. There is insufficient evidence to recommend the routine use of antacids, metoclopramide or H_2-receptor antagonists before elective surgery in non-obstetric patients, but an H_2-receptor antagonist should be given before elective caesarean section, with an

Published online 28 June 2011

chewing gum, sucking a boiled sweet or smoking immediately prior to induction of anaesthesia. These recommendations also apply to patients with obesity, gastro-oesophageal reflux and

Why were these guidelines produced?

Widespread consultation suggested that guidelines on perioperative fasting would be useful to European Society of Anaesthesiology (ESA) members.

Our guideline aims to provide an overview of the present knowledge on perioperative fasting with assessment of the quality of the evidence in order to allow anaesthesiologists all over Europe to integrate this knowledge in their daily care of patients.

What is similar to previous guidelines?

The ESA guidelines endorse a 2-h fasting interval for clear fluids and a 6-h interval for solids.

What is different from previous guidelines?

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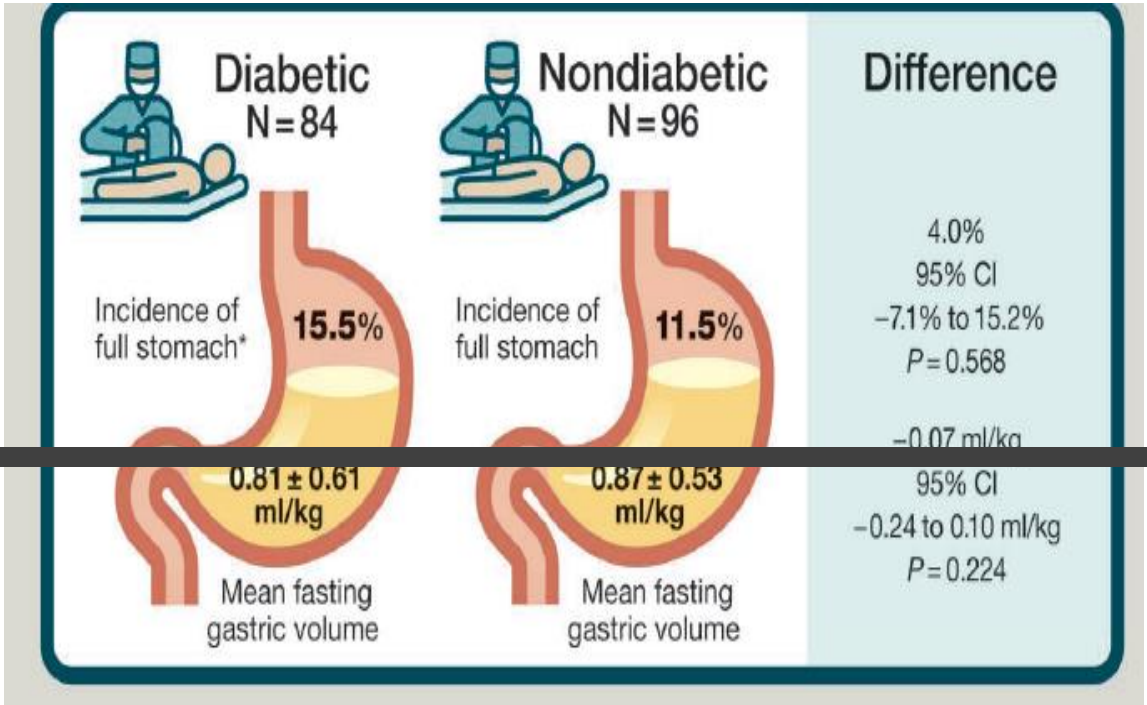
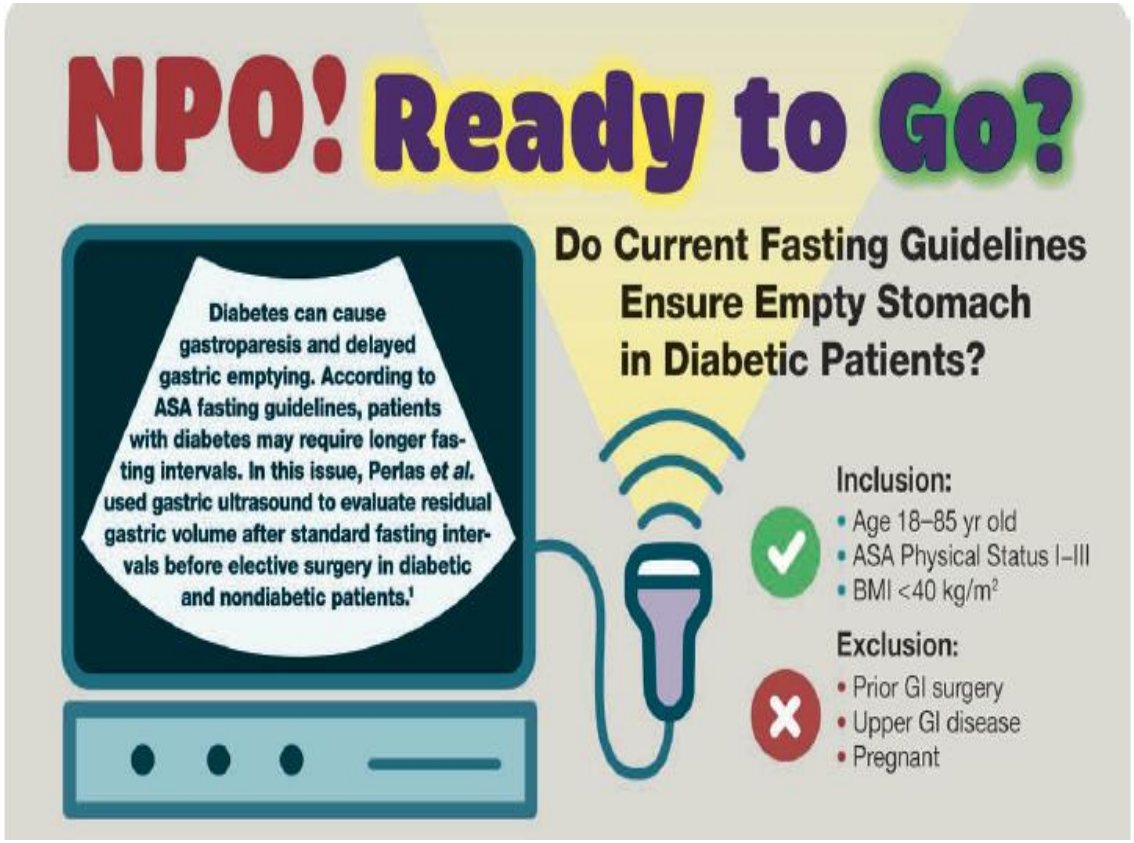
Eur J Anaesthesiol 2011;28:556–569





Question for Future Study[2]

Does administration of glucagon-like peptide-1 (GLP-1) agonists affect safe fasting guidelines?

Conclusion

Fasting guidelines are noninferior in diabetic patients compared to nondiabetic patients with BMI <40 kg/m².

ANESTHESIOLOGY

Baseline Gastric Volume in Fasting Diabetic Patients Is Not Higher than That in Nondiabetic Patients: A Cross-sectional Noninferiority Study

Anahi Perlas, M.D., F.R.C.P.C., Maggie Z. X. Xiao, B.Sc., George Tomlinson, Ph.D., Binu Jacob, Ph.D., Sara Abdullah, M.D., Richelle Kruisselbrink, M.D., F.R.C.P.C., Vincent W. S. Chan, M.D., F.R.C.P.C.

ANESTHESIOLOGY 2024; 140:648–56

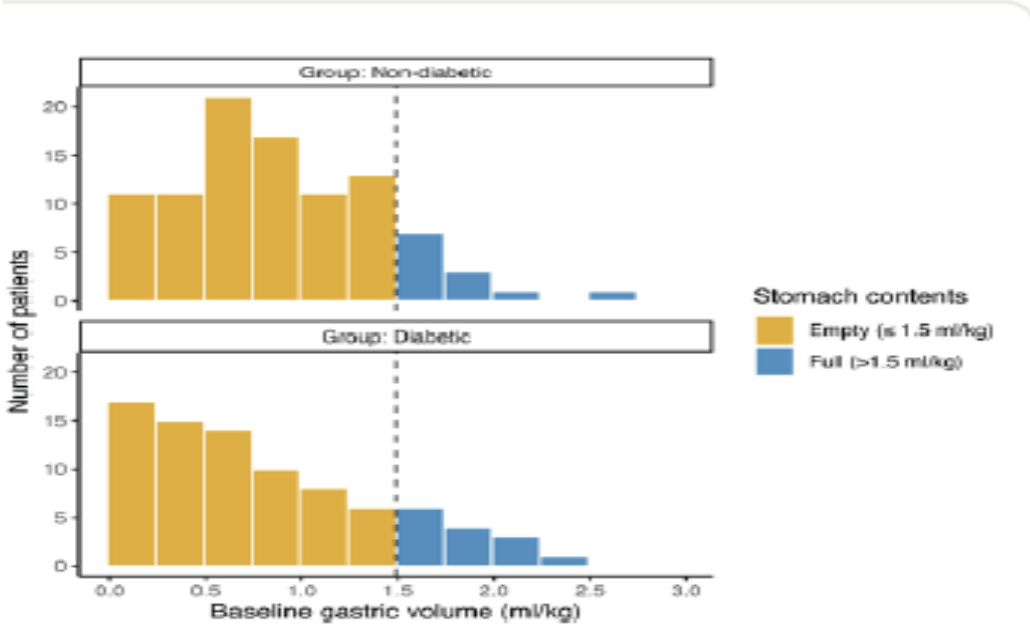


Fig. 4. Distribution of baseline gastric volumes in diabetic and nondiabetic patients. A conventional threshold of 1.5 ml/kg is used as a marker of a full stomach.

STAYING HEALTHY

Weight stigma: As harmful as obesity itself?

June 2, 2022

***By** Chika Anekwe, MD, MPH, Contributor; Editorial Advisory Board Member, Harvard Health Publishing*

DOGMA

"A belief that is accepted by the members of a group without being questioned or doubted"

Opinions develop based on "experience" or inadequate research.

Taught as "facts" to subsequent generations.

"Facts" remain unchallenged.

ISPCOP.NET

International Society for the Perioperative Care of the Obese Patient

THANK YOU FOR YOUR ATTENTION

DAY(S) PRIOR TO THE PROCEDURE:

- Irrespective of indication (diabetes or weight loss), for patients on weekly dosing consider holding GLP-1 agonists a week prior to the procedure/surgery. For patients on daily dosing consider holding GLP-1 agonists on the day of the procedure/surgery.
- If GLP-1 agonists prescribed for diabetes management are held for longer than the dosing schedule, consider consulting an endocrinologist for bridging the antidiabetic therapy to avoid hyperglycemia.

DAY OF THE PROCEDURE:

- If GI symptoms such as severe nausea/vomiting/retching, abdominal bloating, or abdominal pain are present, consider delaying elective procedure, and discuss the concerns of potential risk of regurgitation and pulmonary aspiration of gastric contents with the proceduralist/surgeon and the patient.
- If the patient has no GI symptoms, and the GLP-1 agonists have been held as advised, proceed as usual.
- If the patient has no GI symptoms, but the GLP-1 agonists were not held as advised, proceed with "full stomach" precautions or consider evaluating gastric volume by ultrasound, if possible, and if proficient with the technique. If the stomach is empty, proceed as usual. If the stomach is full or if gastric ultrasound is inconclusive or not possible, consider delaying the procedure or treat the patient as "full stomach" and manage accordingly. Discuss the concerns of potential risk of regurgitation and pulmonary aspiration of gastric contents with the proceduralist/surgeon and the

PREOPERATIVE

- ✓ Avoid premedication
- ✓ **Avoid prolonged fasting**
- ✓ Initiate thromboprophylaxis
- ✓ Diet-modified weight reduction
- ✓ Psychological motivation

INTRAOPERATIVE

- ✓ Minimally invasive surgery
- ✓ Short-acting anesthetics
- ✓ Nonopioid analgesia
- ✓ Locoregional analgesic supplement + NSAIDS
- ✓ Avoid hypothermia
- ✓ Protective ventilation

POSTOPERATIVE

- ✓ Fully awake/reversed → extubation
- ✓ Nonopioids analgesics
- ✓ Lung expansion exercises
- ✓ PONV prophylaxis
- ✓ Early catheter/drain removal
- ✓ Early oral nutrition
- ✓ Avoid NG tube
- ✓ Early ambulation

Meta-Analysis of Enhanced Recovery Protocols in Bariatric Surgery

Methods

13 published studies

- ✓ 4,259 ERAS
- ✓ 1,913 non-ERAS

6,172 cases

Length of Stay

-1.5 days [-1.8, -1.2]

p < 0.01

Adverse events

0.7 [0.6, 0.9]

p < 0.01

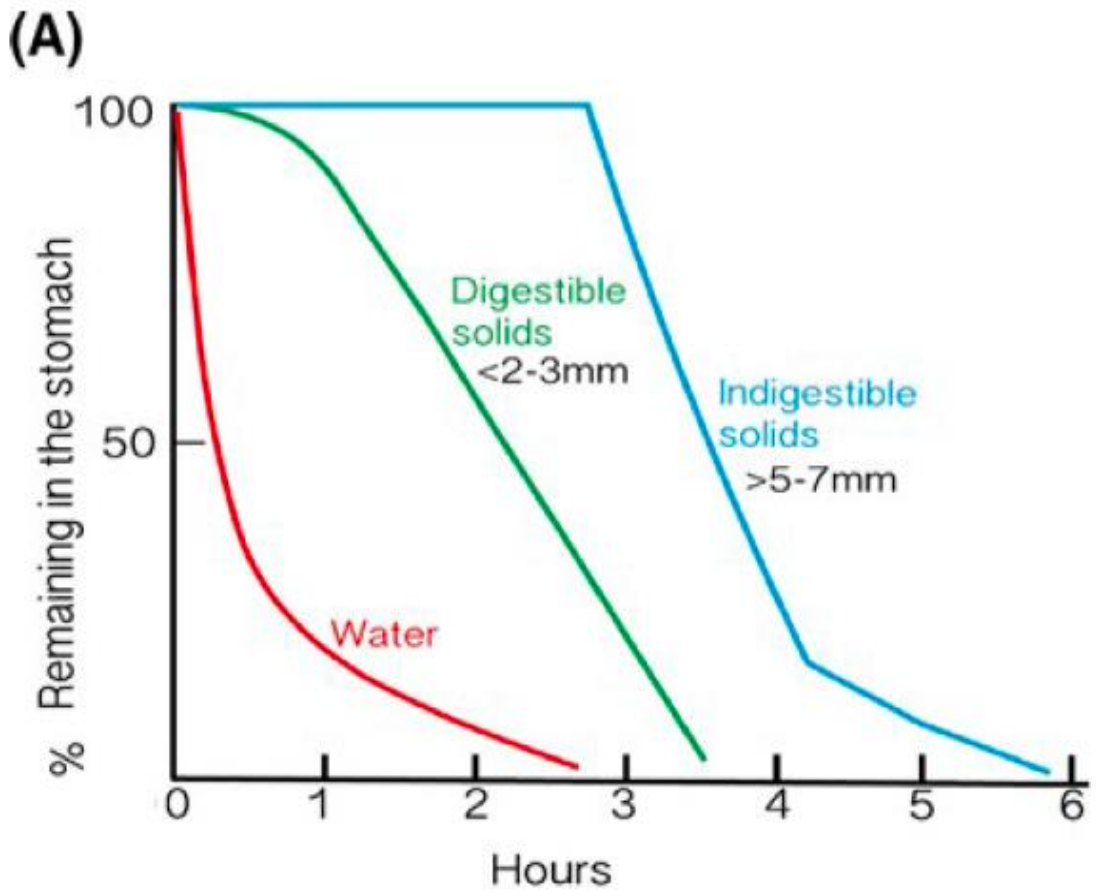
Reinterventions & Readmission

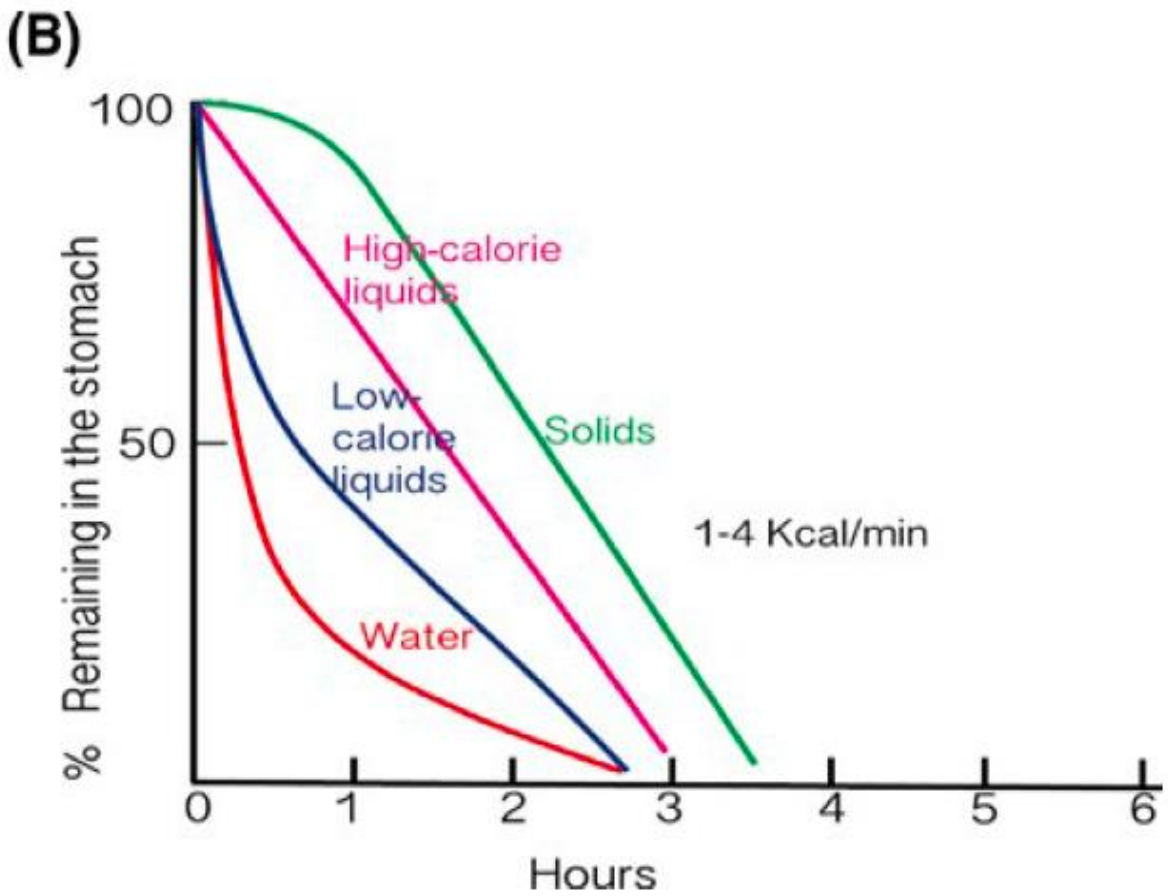
1.0 [0.8, 1.4]

p = 0.87

J Gastrointest Surg. 2018 Feb 27.

Gastric Emptying: *volume, osmolality, chemical composition, and caloric density of the food*





Neurogastroenterol Motil. 2019 Apr;31(4):e13546.

1949 - 1982

1949	Hunt[14]	2–3 hr	NPO midnight
1951	Guedel[15]	No guideline	No guideline
1955	Eliason et al[16]	4 hr	p.m. surgery: breakfast
1964	Lee and Atkinson[17]	NPO midnight or 6 hr	NPO midnight or 6 hr
1970	Cohen and Dillon[18]	NPO midnight	NPO midnight
1971	Wylie[19]	5 hr	5 hr
1976	Canadian Anaesthetists' Society[20]	5 hr	5 hr
1976	Collins[21]	NPO midnight	p.m. surgery: breakfast
1982	Dripps et al[22]	NPO midnight	NPO midnight

Best Pract Res Clin Anaesthesiol. 2006 Sep;20(3):363-78.

PRACTICE PARAMETERS

Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures

*An Updated Report by the American Society of Anesthesiologists Task Force on Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration**

PRACTICE guidelines are systematically developed recommendations that assist the practitioner and patient in making decisions about health care. These recommendations may be adopted, modified, or rejected according to clinical needs and constraints, and are not intended to replace local institutional policies. In addition, practice guidelines developed by the American Society of Anesthesiologists (ASA) are not intended as standards or absolute requirements, and their use cannot guarantee any specific outcome. Practice guidelines are subject to revision as warranted by the evolution of medical knowledge, technology, and practice. They provide basic recommendations that are supported by a synthesis and analysis of the current literature, expert and practitioner opinion, open forum commentary, and clinical feasibility data.

This document updates the "Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: An Updated Report" adopted by the ASA in 2010 and published in 2011.†

Methodology

Definition of Preoperative Fasting and Pulmonary Aspiration

For these guidelines, *preoperative fasting* is defined as a prescribed period of time before a procedure when patients are not allowed the oral intake of liquids or solids. *Perioperative pulmonary aspiration* is defined as aspiration of gastric contents occurring after induction of anesthesia, during a procedure

these guidelines, the term "preoperative" should be considered synonymous with "preprocedural," as the latter term is often used to describe procedures that are not considered to be operations. Anesthesia care during procedures refers to general anesthesia, regional anesthesia, or procedural sedation and analgesia.

Purposes of the Guidelines

The purposes of these guidelines are to provide direction for clinical practice related to preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration and to reduce the severity of complications related to perioperative pulmonary aspiration. Clinical practice includes, but is not limited to, withholding of liquids and solids for specified time periods before surgery and prescribing pharmacologic agents to reduce gastric volume and acidity. Enhancements in the quality and efficiency of anesthesia care include, but are not limited to, the utilization of perioperative preventive medication, increased patient satisfaction, avoidance of delays and cancellations, decreased risk of dehydration or hypoglycemia from prolonged fasting, and the minimization of perioperative morbidity. Complications of aspiration include, but are not limited to, aspiration pneumonia, respiratory compromise, and related morbidities.

Focus

Prevention of perioperative pulmonary aspiration is part of the process of preoperative evaluation and preparation of the patient. The guidelines specifically focus on preoperative fast-

- *Clear liquid:* **2h**
- *Breast milk:* **4h**
- *Nonhuman milk:* **6h**
- *Light meal:* **6h**
- *Fried, fatty foods or meat:* **8h**

Melbourne 2024

Anesthesiology 2017 Mar; 126(3):376-393.