Embracing Metabolic Surgery as a Treatment for Type 2 Diabetes

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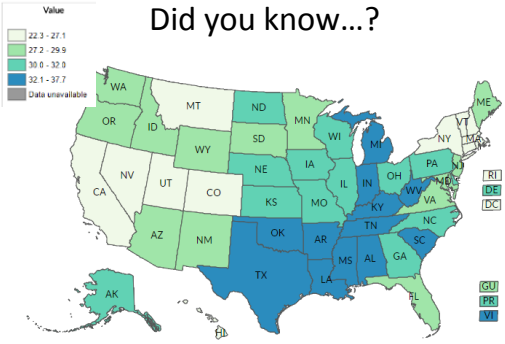
Objectives

- Describe the mechanisms of diabetes improvement from metabolic surgery
- State one nutrition protocol for preoperative and postoperative metabolic surgery patients
- Identify an appropriate candidate for metabolic surgery

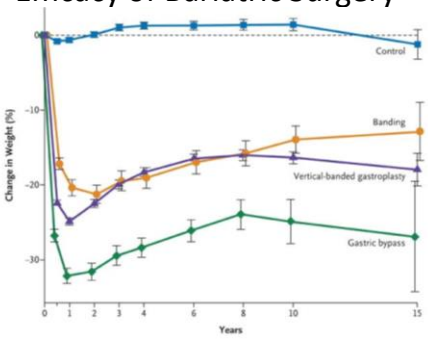
Agenda

- Metabolic Surgery
  - What is it?
  - How does it work?
- Nutrition Protocols
  - Pre-, peri-, & postoperative management
- Appropriate Candidates
  - Who and how to refer
  - Communicating about surgery

Did you know…?

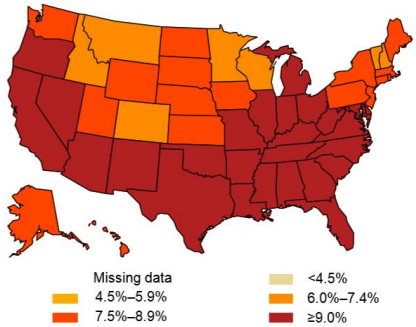


Efficacy of Bariatric Surgery



Sjostrom et al. 2007

Did you also know…?



Diabetes & Obesity

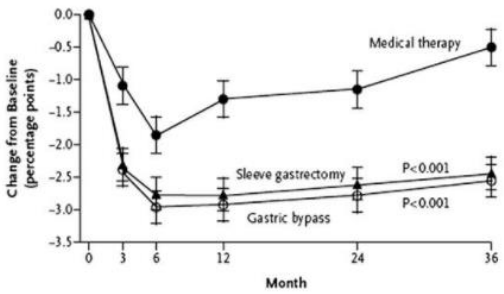
Almost 90% of people with type 2 diabetes have obesity

6-fold increase in diabetes development for people with BMI > 40 compared to normal BMI

People with diabetes have annual health care expenditures of $13,581 compared to $3,954 for those without diabetes

Yee et al. 2017

Efficacy of Metabolic Surgery



Schauer et al. 2016

What's in a Name?

- Proposed definition for Metabolic Surgery
  - A set of gastrointestinal operations used with the intent to treat diabetes and metabolic dysfunctions (which include obesity)

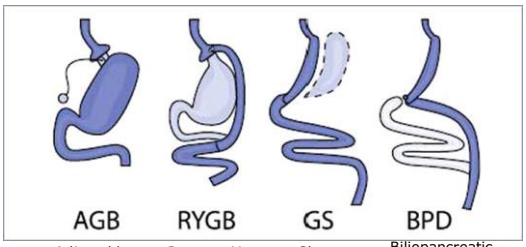
Rubino et al. 2014

Professional Consensus

1st Diabetes Surgery Summit (Rome)	• Metabolic surgery seems legitimate but RCTs needed
2nd Diabetes Surgery Summit (London)	• Sufficient evidence to support metabolic surgery as antidiabetes treatment

Rubino et al. 2016

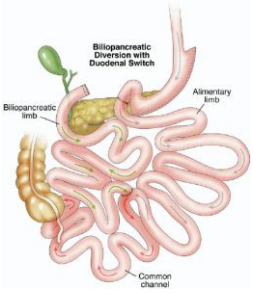
Common Metabolic Surgeries



AGB	RYGB	GS	BPD
Adjustable Gastric Banding	Roux-en-Y Gastric Bypass	Sleeve Gastrectomy	Biliopancreatic Diversion with Duodenal Switch

BPD with Duodenal Switch

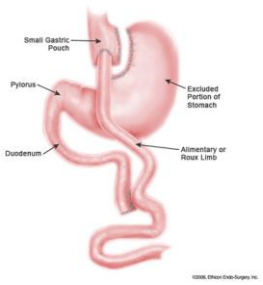
- Developed in 1988 in Ohio
  - Create sleeve and keep 2-4 cm duodenum
  - Dissect duodenum and ileum
  - Common channel is 80-150 cm
- 70-75% EWL
- Micronutrient & macronutrient malabsorption



Elder & Wolfe 2007; ASMBS 2004

Gastric Bypass

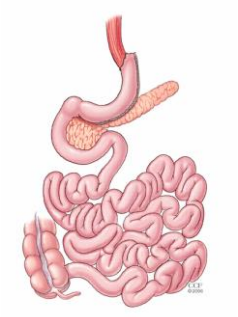
- Developed in 1970s
  - Upper part of stomach dissected to create pouch
  - Jejunum dissected and connected to pouch
- 60-70% EWL
- Micronutrient malabsorption
- Dumping syndrome
- GJ ulcer



Elder & Wolfe 2007; ASMBS 2004

Sleeve Gastrectomy

- Used as first step to BPD in 2000
  - Stomach is vertically dissected; about 80% is removed
- 50-60% EWL
- Strictures
- Leaks
- Micronutrient malabsorption
- Complicated relationship with heartburn



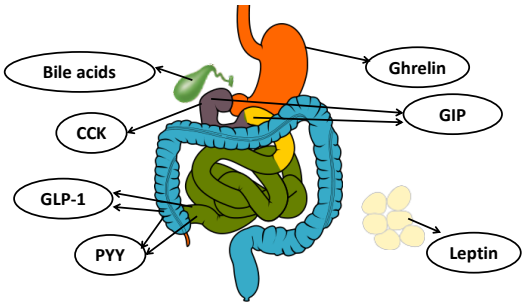
ASMBS 2004

The Main Metabolic Players

Incretins	• Induce insulin secretion in response to food
Ghrelin	• Signals hunger in response to empty stomach
Leptin	• Signals need for increase energy consumption
PYY & CCK	• Inhibit gastric emptying; reduce appetite
Bile Acids	• Improve glucose tolerance through FXR activation

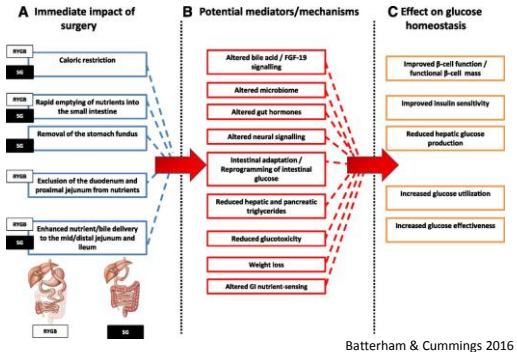
Albaugh et al 2017; Meek et al 2016

The Main Metabolic Players



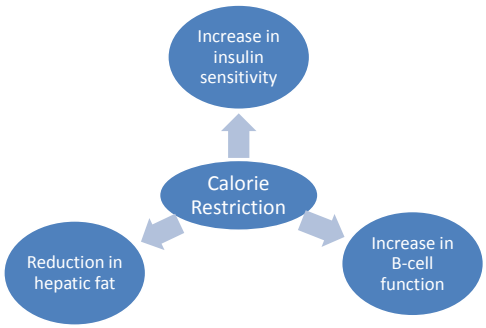
Albaugh et al 2017; Meek et al 2016

Potential Mechanisms



Batterham & Cummings 2016

Immediate Impacts



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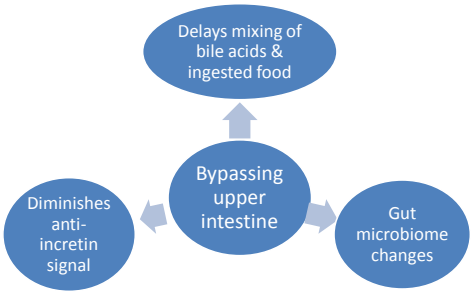

Batterham & Cummings 2016

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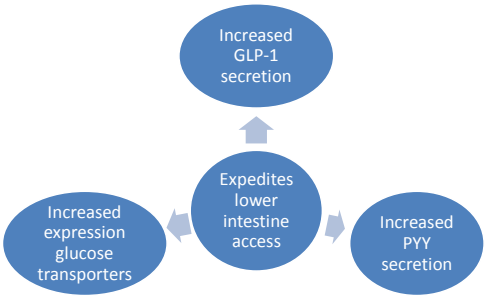
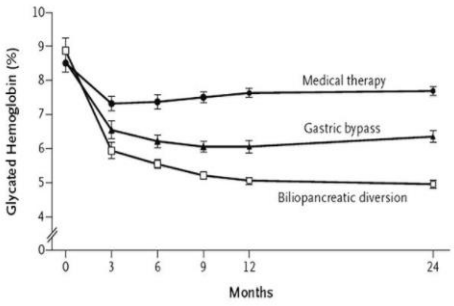


Batterham & Cummings 2016

Metabolic Surgery Outcomes



Schauer et al. 2016

Outcome Definitions

Complete Remission	Partial Remission
• FBG < 100 mg/dl **and/or** • A1C < 6%	• FBG < 126 mg/dl **and/or** • A1C < 6.5%
• For at least 1 year without antidiabetic meds	• For at least 1 year without antidiabetic meds

Schauer et al. 2016

Difference in Definitions

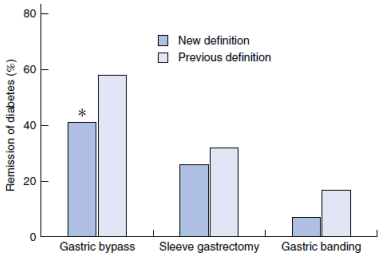


Fig. 1 Remission of diabetes after gastric bypass, sleeve gastrectomy and gastric banding based on the new (2009 consensus statement)[1] and the previous[2,3] definitions. $P < 0{\cdot}001$

Pournaras et al. 2011

NUTRITION MANAGEMENT

Preoperative Management

- Assess nutrition status
- Improve glycemic control
- Manage expectations
- Educate on lifestyle changes
- Prevent hypoglycemia during pre-op diet

Assess Nutrition Status

"All patients should undergo an appropriate nutritional evaluation, including micronutrient measurements, before any bariatric surgical procedure."

- LFTs
- Lipids
- CBC with differential
- HbA1C
- Serum iron, ferritin, & TIBC
- Serum B1 & B12
- Serum folate or plasma homocysteine
- Serum Ca & alkaline phosphatase
- PTH & 25(OH)-D

Cummings & Isom 2014; Mechanick et al. 2013

Improve Glycemic Control

- Optimize preoperative glycemic control via medical nutrition therapy, physical activity, oral meds, and insulin
- HbA1C
  - Ideally ≤ 7.0%
  - 7.0-8.0% in case of extensive comorbids
  - > 8.0% - use clinical judgment
- Blood glucose
  - Fasting ≤ 110 mg/dL
  - 2-hour postprandial ≤ 140 mg/dL

Cummings & Isom 2014; Mechanick et al. 2013

Preoperative Education

- Effect of surgery on digestion and absorption
- Eating behaviors to prevent GI distress
- Preoperative diet protocol
- Postoperative diet protocol
- Micronutrient supplementation

Pre-op Diets

- Pre-op diets are low in carbohydrates to reduce liver glycogen stores
  - Evidence-based protocol: 1000 kcal, 50-60 g carbohydrate daily for 2 weeks

Colles et al. 2006

Preventing Hypoglycemia

- Highest risk meds
  - Insulin
  - Sulfonylureas
  - Thiazolidinediones
  - SGLT2 inhibitors
- Increase daily carbohydrate intake
- Treat lows with glucose tablets
- Collaborate with primary care provider or endocrinologist to adjust meds

Immediate Post-op Management

OBES SURG (2015) 25:2200–2204
DOI 10.1007/s11695-015-1860-y

NEW CONCEPT

Inpatient Glycemic Protocol for Patients with Diabetes Undergoing Bariatric Surgery

Karolina Machnica[1] · Silvana Pannain[2] · Elizabeth Schulwolf[3] · Jessica Bartfield[4] · Mary Ann Emanuele[5]

- Interdisciplinary workgroup published a protocol in 2015

Glycemic Control Protocol

Starting dose after surgery	
Glargine 100 units/mL	0.2 units/kg daily dosing
Titration of glargine[a]	
Any blood sugar <120 mg/dL	Decrease dose by 10 %
Any blood sugar <80 mg/dL	Decrease dose by 20 %
Lispro correction algorithm—dosed three to four times per day	
Blood sugar 180–210 mg/dL	1 unit of lispro
Blood sugar 211–240 mg/dL	2 units of lispro
Blood sugar 241–270 mg/dL	3 units of lispro
Blood sugar 271–300 mg/dL	4 units of lispro
Blood sugar 301–330 mg/dL	5 units of lispro
Blood sugar >330 mg/dL	6 units of lispro
Hypoglycemia correction if eating: continue algorithm until blood sugar ≥90 mg/dl 1 h after treatment	
Blood sugar <50 mg/dL	4 glucose tablets, recheck in 15 min
Blood sugar 50–69 mg/dL	3 glucose tablets, recheck in 15 min
Blood sugar 70–89 mg/dL	2 glucose tablets, recheck in 1 h
Hypoglycemia correction if NPO: continue algorithm until blood sugar ≥90 mg/dl 1 h after treatment	
Blood sugar <50 mg/dL	50 mL 50 % dextrose solution, recheck in 15 min
Blood sugar 50–69 mg/dL	25 mL 50 % dextrose solution, recheck in 15 min
Blood sugar 70–89 mg/dL	25 mL 50 % dextrose solution, recheck in 1 h
Discharge glargine insulin regimen: based on last glargine dose in hospital	
Requiring <10 units	No insulin at discharge
Requiring 10–19 units	Glargine 10 units daily
Requiring 20–29 units	Glargine 15 units daily
Requiring 30–39 units	Glargine 20 units daily
Requiring 40–49 units	Glargine 30 units daily
Requiring >49 units	Glargine 40 units daily

Machnica et al. 2015

Inpatient Protocol Highlights

- Target for random BG: 120-180 mg/dl
- Test with finger sticks every 6 hours
- Initiate basal insulin (glargine) at 0.2 units/kg
  - Adjust up or down based on BG results and need for correctional insulin
- IV D50 or glucose tablets can be used to treat lows

Machnica et al. 2015

Discharge Protocol Highlights

- Follow up with PCP or endocrinologist in 2-4 weeks
- Suggestion to hold metformin for 2-3 weeks due to risk of nausea
  - Extended release typically best tolerated
- Consider DPP-4 inhibitor
- Test with finger sticks 2x/day
- Treat lows with glucose tablets

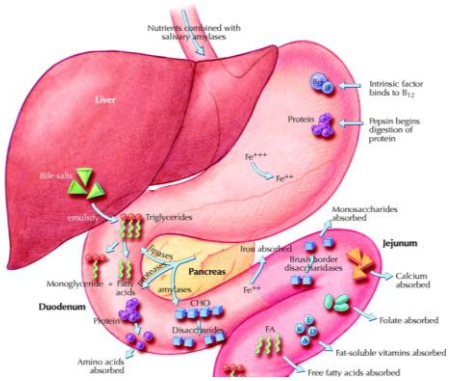
Machnica et al. 2015

Diet Progression

Diet Stage	Duration	Components
Clear Liquids	4-24 hours	Sugar-free, low-calorie, noncarbonated beverages
Protein Supplements + Semi-Solid Foods	14-21 days (7 days band)	Protein supplements, yogurt, smooth soups, cottage cheese, ricotta cheese, pureed fruits and vegetables
Soft Textures	14-21 days (7 days band)	Tender poultry and fish, tofu, eggs, legumes, hot cereal (oatmeal, cream of wheat), soft fruits with no peels and seeds, well-cooked vegetables with no peels and seeds
Regular Textures	Lifelong	Guide patient toward balanced diet with lean protein, fruits, vegetables, whole grains, healthy fats, and low-fat dairy (if desired). Foods initially challenging to tolerate include red meat, raw vegetables, bread, rice, and pasta.

Micronutrient Needs

- Reduced intake of food after surgery
  - Potential aversions and food intolerances
- Changes to GI tract
  - Intrinsic Factor (IF) in fundus of stomach
  - Fewer parietal cells secreting hydorchloric acid (HCl)
    - Less acidic environment
  - Bypass of duodenum and jejunum



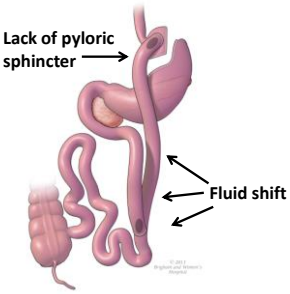
Jeejeebhoy, K., 2002

Micronutrient Needs

Iron 18-60 mg	Vitamin A 5000-10000 IU
Folate 350-500 mcg	Vitamin E 15mg
B12 350-500 mcg	Vitamin K 90-300 mcg
Thiamin 12-50mg	Zinc 8-22 mg
Calcium 1200-2400 mg	Copper 1-2 mg
Vitamin D 3000 IU	Selenium & Magnesium

Parrott et al. 2016

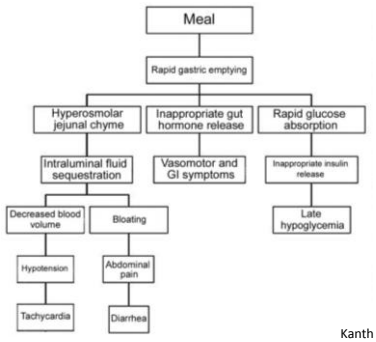
Pathophysiology of Dumping Syndrome



- Rapid passage of nutrients to the small intestine which causes an osmotic fluid shift
- Triggered by simple carbohydrates
- Symptoms are gastrointestinal and vasomotor

Tack 2009

Pathophysiology of Dumping Syndrome



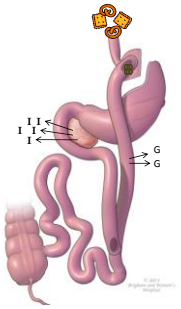
Kanth & Roy 2017

Nutrition Intervention

- Avoid added sugars in beverages and foods
  - Sometimes natural sugars (fructose, lactose) can be problematic
- Avoid eating and drinking at the same time
  - Drink 30 to 60 min after eating
  - Be mindful of watery foods like soups
- Pectin, guar gum, glucomannan?

Tack 2009

Pathophysiology of Reactive Hypoglycemia



- Rapid hypoglycemia from exaggerated insulin response (incretin effect)
- Food moves to small intestine more quickly; triggers hormone release (GLP-1 and GIP) which stimulates insulin response
- Symptoms of hypoglycemia occur 1-3 hours after a meal

Ukleja 2006

Nutrition Intervention

Goal: Delay transit of food through GI tract

- Small, frequent meals (5-6 times per day)
- Limit carbohydrate to 15-30 grams per meal
  - Choose complex carbohydrate foods
- Have source of protein and/or fat at each meal
- Avoid drinking during meal and 30 min after
- Pectin, guar gum, glucomannan?

Ukleja 2006; Botros et al. 2014; Ritz et al. 2012

Beyond Nutrition Management

- Acarbose (glucosidase inhibitor) may be used in addition to diet intervention
- Reversal of gastric bypass
- Partial pancreatectomy

Ukleja 2006

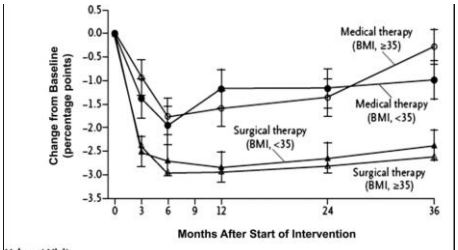
CANDIDATES FOR SURGERY

Candidates for Surgery

- BMI 40+
- BMI 30-39.9 when hyperglycemia is inadequately controlled by lifestyle and medical therapy
- Lower BMI thresholds by 2.5 for Asian patients

Schauer et al. 2016

Expanding the Candidate Pool



Value at Visit					
Medical <35 BMI	9.1 (8.9)	7.2 (6.8)	7.9 (6.9)	8.0 (7.4)	8.1 (7.8)
Medical ≥35 BMI	8.8 (8.5)	7.1 (6.8)	7.2 (6.7)	7.4 (6.9)	8.5 (7.3)
Surgical <35 BMI	9.4 (9.1)	6.7 (6.9)	6.6 (6.6)	6.8 (6.8)	7.1 (6.7)
Surgical ≥35 BMI	9.3 (9.2)	6.4 (6.2)	6.4 (6.1)	6.6 (6.4)	6.7 (6.4)

Cummings & Cohen 2016

Predictors of Outcomes

Higher remission rates

T2DM < 8 years
Lower pre-op FG
RNY or BPD-DS

T2DM > 8 years
Pre-op need for insulin
Poorer glycemic control
Low C-peptide levels

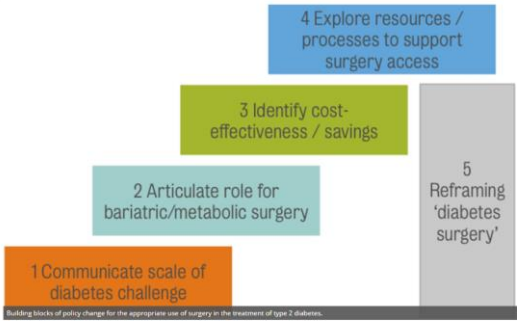
Lower remission rates

Batterham & Cummings 2016; Schauer et al. 2016

Barriers to Surgery

- Lack of knowledge about surgery – patient and/or provider
- Weight bias
- Limited access to care
- Insurance coverage

Building Blocks of Policy Change



Referring a Candidate

- Find out how patients feel about surgery
- Find out how providers feel about surgery
- Advocate with data
- Look for MBSAQIP accredited centers

Summary

- Metabolic surgery is an effective but underused treatment for type 2 diabetes.
- Dietitians play a key role in optimizing pre- and post-op success.
- Early referral to surgery and management of expectations are important components of care.

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