

# METABOLIC EFFECTS OF BARIATRIC SURGERY

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# OBJECTIVES

- To understand obesity treatment strategy
- To learn when surgery is indicated
- To understand the metabolic changes resulting from bariatric surgery
- To facilitate the process for our patients choosing bariatric surgery

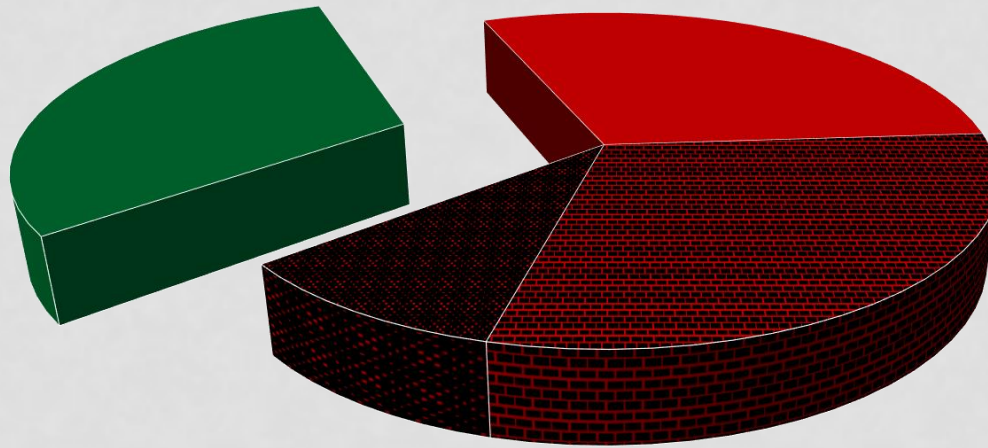
# DISCLOSURES

- Financial: None
- I have a normal BMI





# WEIGHT IN THE US



■ "Normal Weight" 30%   ■ Overweight 30%   ■ Obese 30%   ■ Severely Obese 10%

BMI: 19-25

26-39

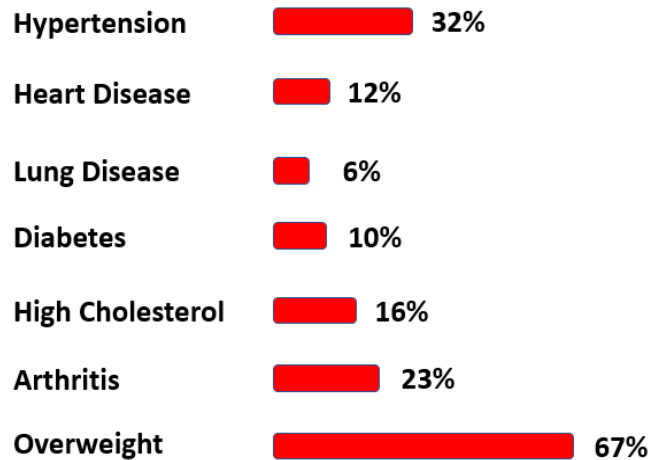
35-39

>40

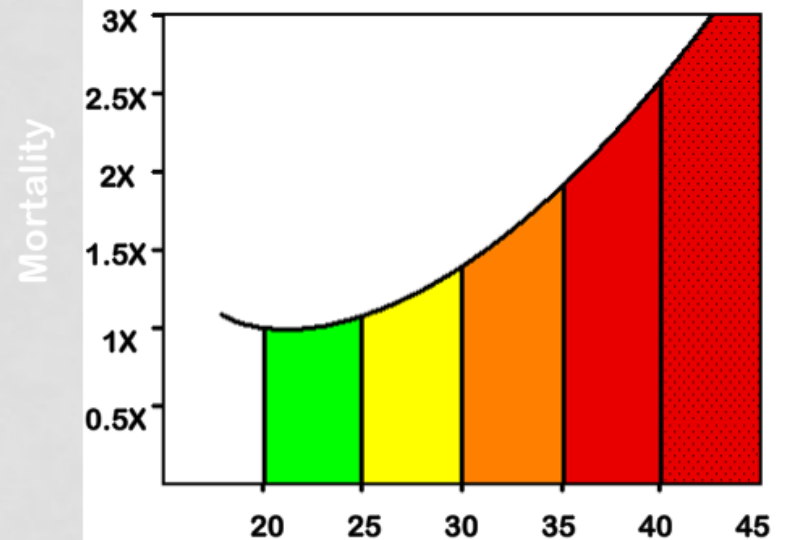
# US ADULTS

## Lifestyle Diseases

Percentage of US Adults with Lifestyle Diseases (CDC)



## All cause mortality



BMI

# BENEFITS OF 5-10% WEIGHT LOSS

- Increase HDL by 5
- Decreases Triglycerides by 40
- 5mmHg decrease in SBP and DBP
- HbA1c reduction by 0.5
- Decrease insulin levels
- Improves sleep apnea
- Decreased inflammation (CRP, TNF $\alpha$ )

# OBESITY TREATMENT STRATEGY

Self Directed Lifestyle Change

Professionally-directed Lifestyle Change

Pharmacotherapy

Weight Loss Surgery

Post Surgical  
Combinations





## Self Directed Lifestyle Change



- Portion adjustment
- Keto: low carb, high fat
- Meal replacements- shakes or bars
- Intermittent fasting
- Macros
- Calorie counting

Self Directed Lifestyle Change

Professionally-directed Lifestyle Change

stress

rx

food

sleep

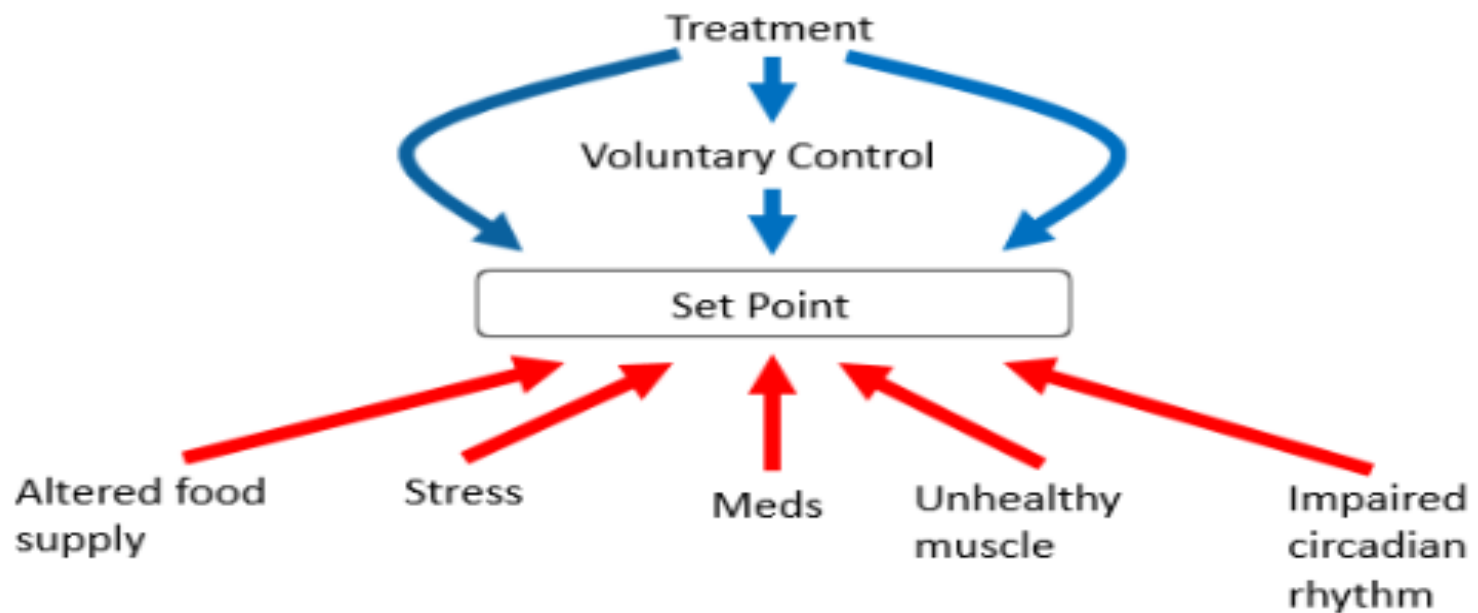
**SET  
POINT**

# METABOLIC SET POINT

- $\text{Calories consumed} - \text{calories expended} = \text{Weight}$
- If energy intake in one year is 912,500 calories and 4,050 calories leads to a 1 pound weight gain in a year.
  - Then error of 0.4% or 11 calories a day

# BODY DEFENDS SET POINT

## The Battle for Set Point





Self Directed Lifestyle Change

Professionally-directed Lifestyle Change

**Pharmacotherapy**

# COMMON MEDICATIONS THAT CAUSE OBESITY

- Antipsychotic
- Antidepressants & Mood Stabilizers
- Anticonvulsants
- Diabetes medications
- Contraceptives
- Beta blockers

# GLP-1 RECEPTOR AGONIST

## **Semaglutide (Wegovy)**

- Once weekly injection
- Weight loss: 10-15 kg

## **Liraglutide (Saxenda)**

- Daily injection
- Weight loss: 4-8 kg

- Side effects: nausea, vomiting, constipation and diarrhea
- Do not take if you are pregnant, have a history of pancreatitis or personal or family history of medullary thyroid cancer or multiple endocrine neoplasia 2A or 2B

# GIP + GLP-1 AGONIST

## **Tirzepatide (Zepbound)**

- Once weekly injection
- Weight loss: 16-23 kg
- Side effects: nausea, vomiting, constipation and diarrhea
- Do not take if you are pregnant, have a history of pancreatitis or personal or family history of medullary thyroid cancer or multiple endocrine neoplasia 2A or 2B



# PHENTERMINE- EXTENDED RELEASE TOPIRAMATE (QSYMIA)

- Pill taken once daily
- Weight loss: 6-10 kg
- Side effects: dry mouth, constipation, increase in depression/anxiety, disturbances in attention, increased heart rate
- Stop if weight loss not greater than 5% of baseline after 12 weeks; taper to discontinue
- Do not take if you are pregnant, have hyperthyroidism, glaucoma or a history of renal stones

# EXTENDED-RELEASE BUPROPION- NALTREXONE (CONTRAVE)

- Pill titrated to two tablet twice daily
- Weight loss: 4-5% of baseline
- Side effects: nausea, headache, constipation, insomnia, vomiting, dizziness, dry mouth, increased risk for cardiovascular event, increased risk of suicidal behavior in patients 18-24 years old
- Do not take if you are pregnant, have uncontrolled blood pressure, seizure disorder, eating disorder, chronic opioid use, at risk for alcohol withdrawal or severe liver dysfunction

# ORLISTAT (ALLI [OTC], XENICAL)

- Pill taken by mouth three times a day with meals containing fat
- Alters fat digestion and increases fecal fat excretion
- Weight loss: 5-10 kg
- Side effects: gastrointestinal, decreased absorption of fat-soluble vitamins, kidney stones
- Do not take if you are pregnant, have chronic malabsorption, cholestasis or a history of kidney stones

# MEDICATIONS TO TREAT OBESITY

- Phentermine \$15
- Phentermine + topiramate \$20
- Orlistat \$150
- Liraglutide \$1400
- Semaglutide \$185 - \$225
- Bupropion + Naltrexone \$355 - \$555
  
- FDA efficacy
  - 5% in at least 35% of treatment group
  - Double the placebo
  - Comorbidities- 5-10% can improve diabetes and hypertension

Self Directed Lifestyle Change

Professionally-directed Lifestyle Change

Pharmacotherapy

**Weight Loss Surgery**

# WEIGHT LOSS SURGERY

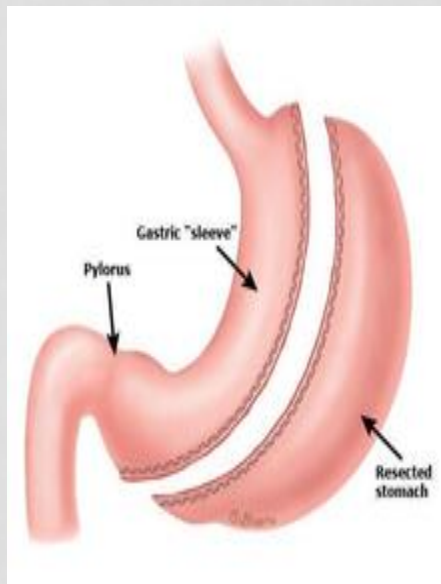
- BMI > 35
  - Pediatric
- BMI 30-40 + co-morbidities
  - Pediatric
- BMI 30-35 + inadequately controlled DMII

# HOW IT WORKS

1. Restriction
2. Malabsorption
3. Altered gut hormones
4. Neural mechanisms- vagal
5. Gut microbiota change
6. Altered thermogenesis – energy expenditure
7. Increased circulating bile acids

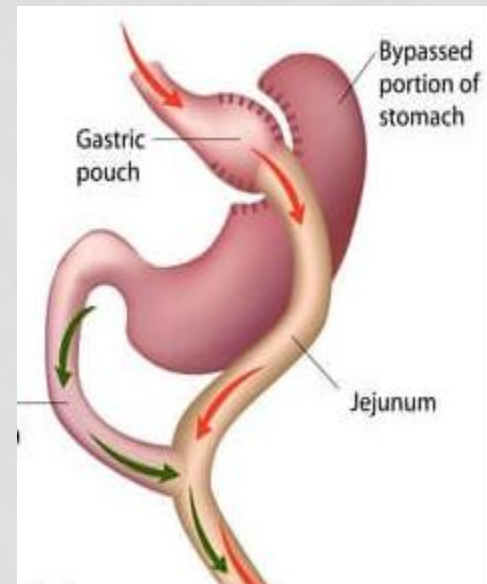
# 1 RESTRICTION

## Sleeve



80%  
2-3 oz

## Roux n y

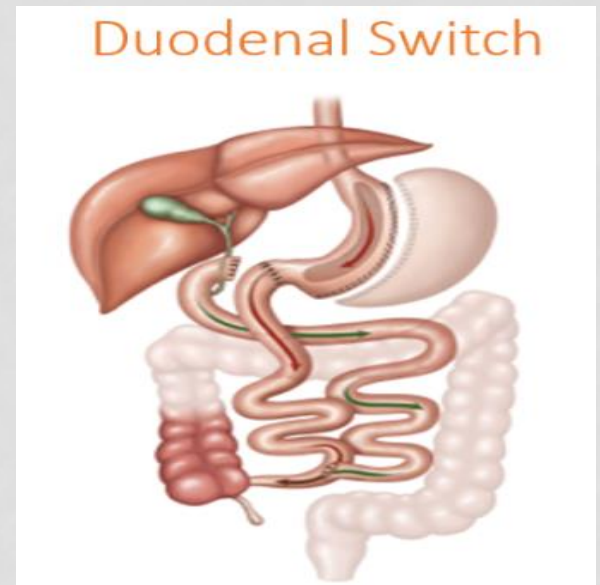
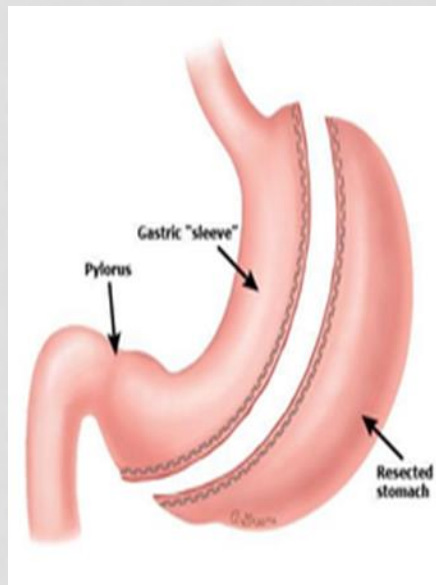
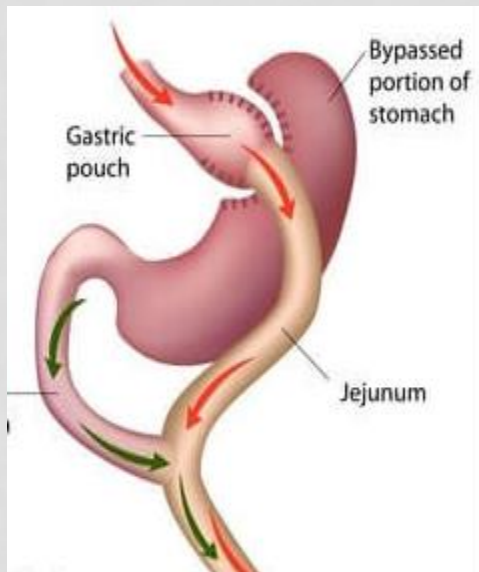


90-95%  
1 oz



# 2

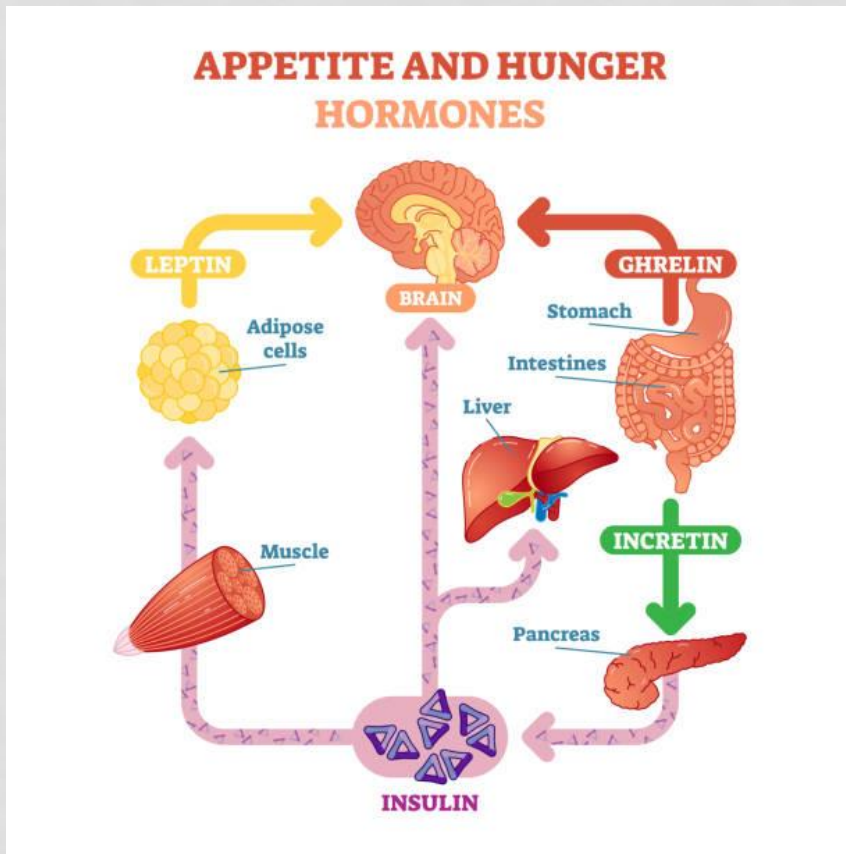
## MALABSORPTION



- **Superior over lap band**
- Rapid gastric emptying
- Increased intestinal transit

# 3

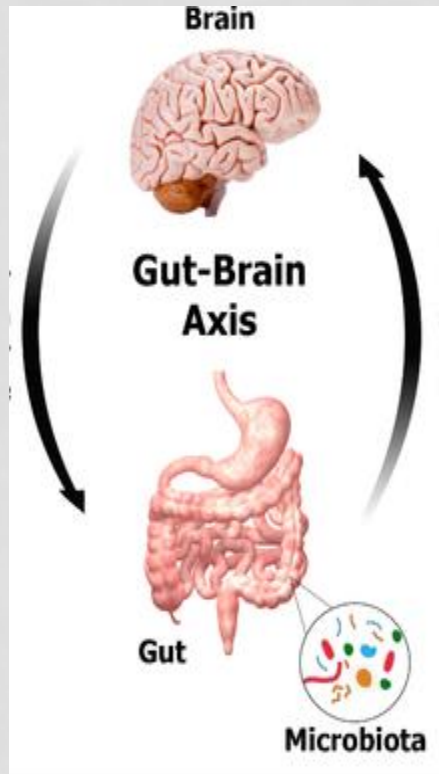
## ALTERED GUT HORMONES



- Decreases Ghrelin
  - Hunger
- Increase Leptin sensitivity
  - Satiety

# 4

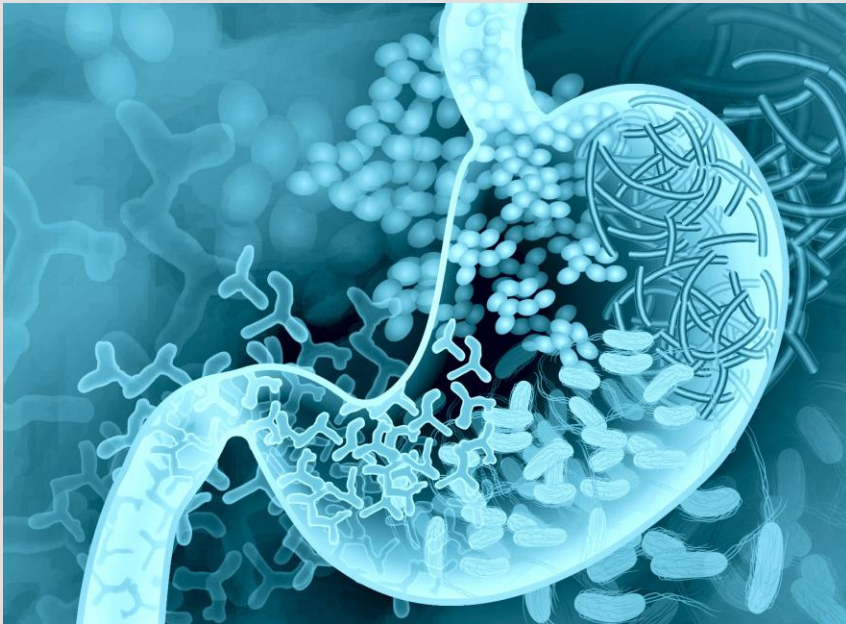
## NEURAL MECHANISMS- VAGAL



- Neuroendocrine pathway of the Gut- Brain axis
  - Satiety
  - Aversion

# 5

## GUT MICROBIOTA CHANGE

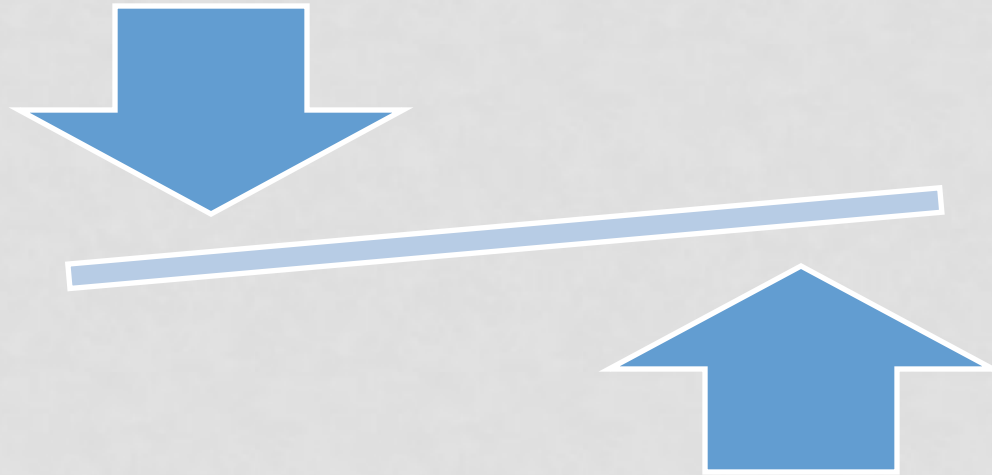


- Inflammation
- Adipocyte size
- Insulin resistance

# 6

## ALTERED THERMOGENESIS

- Homeostatic mechanism that encourages your body to regain weight after weight loss efforts.



- Unclear how or why
  - Superior long term data over comparable caloric restriction

# 7

## INCREASED CIRCULATING BILE ACIDS

- Obese patients have less circulating Bile Acids
- Also changed composition of Bile Acids
  - Dietary changes
  - Gut microbiome
- Bariatric surgery increased deliver of bile and pancreatic fluid to distal small intestines
  - Increasing Bile Acid absorption

# PROPOSED MECHANISMS

- Metabolic mediators:
  - Increase energy expenditure TSH pathways
- Glucose homeostasis
  - Insulin sensitivity- GLP-1
  - Increase intracellular glucose transport in adipocyte
- Appetite suppression
  - via peptides such as GLPs

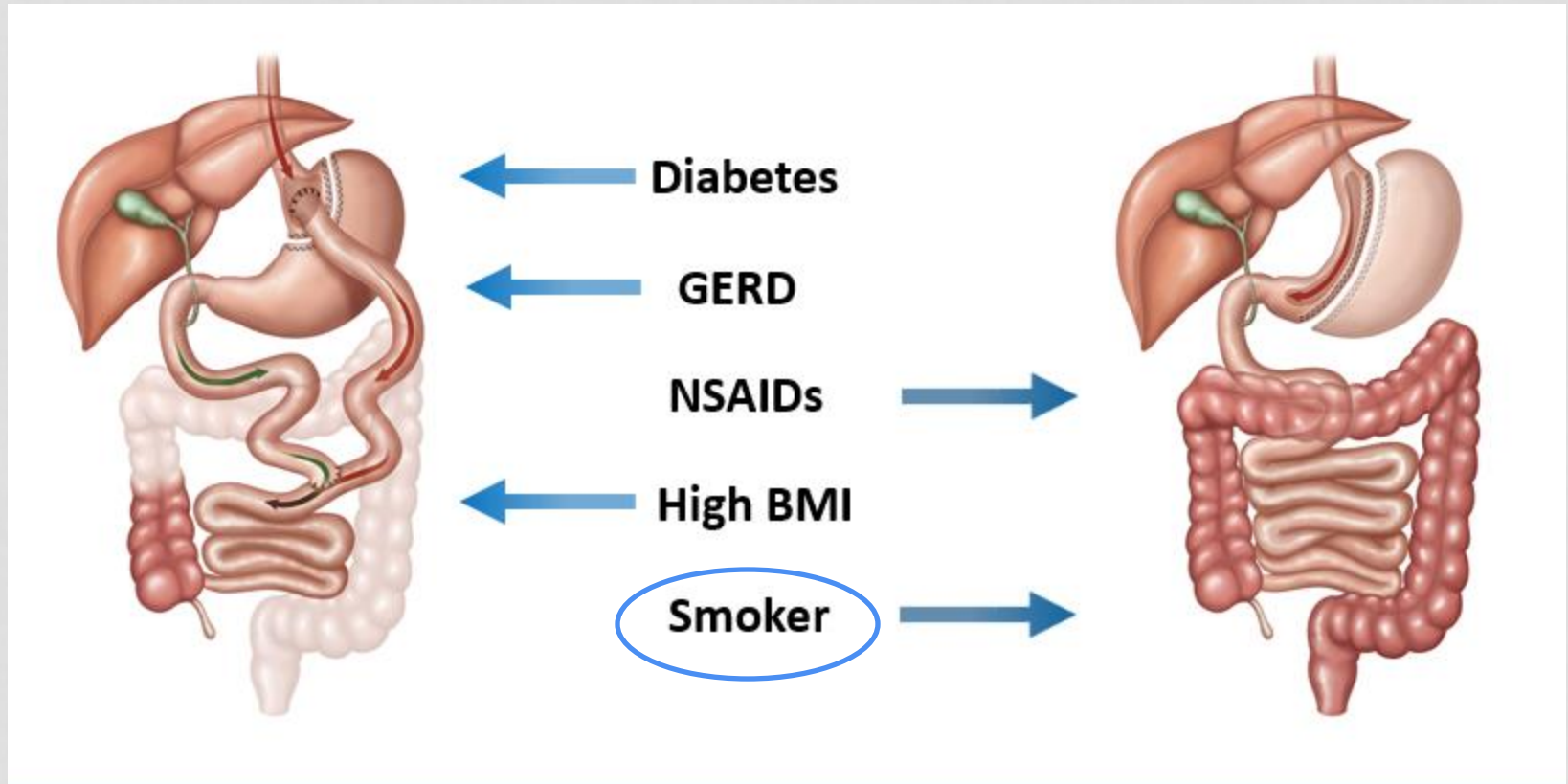


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# WHICH PROCEDURE?



# DIABETES PREDICTORS OF REMISSION

- Diabetes duration
- # medications
- Insulin use
- Glycemic control



# Bariatric Surgical Risk/Benefit Calculator

## Enter Patient and Surgical Information

Please enter as much of the following information as you can to receive the best risk/benefit estimates. A rough estimate will still be generated if you cannot provide all of the information below.

Procedure Types:  Band  Lap Sleeve  Lap Bypass  BPD/DS

BMI Calculation: 46.59

Race: [i](#)

Unknown

ASA Class:

III. Severe Systemic Disease

Diabetes: [i](#)

Non-Insulin

Functional Status: [i](#)

Independent

- Current Smoker within 1-year [i](#)
- Sleep Apnea [i](#)
- History of PE [i](#)
- Cardiac Risk [i](#)
- Vascular Risk [i](#)
- History of Severe COPD [i](#)
- Hypertension requiring medication [i](#)
- Hyperlipidemia [i](#)
- GERD [i](#)
- Dialysis [i](#)
- Previous Foregut Surgery [i](#)
- Steroid Use for Chronic Condition [i](#)

Reset All Selections

Compute Results

## Results

30-day Risk

1-year BMI

1-year Comorbidity Remission

Create Report

Risk Factors:



# Bariatric Surgical Risk/Benefit Calculator



AMERICAN COLLEGE OF SURGEONS  
Inspiring Quality: Highest Standards, Better Outcomes

## Enter Patient and Surgical Information

### Results

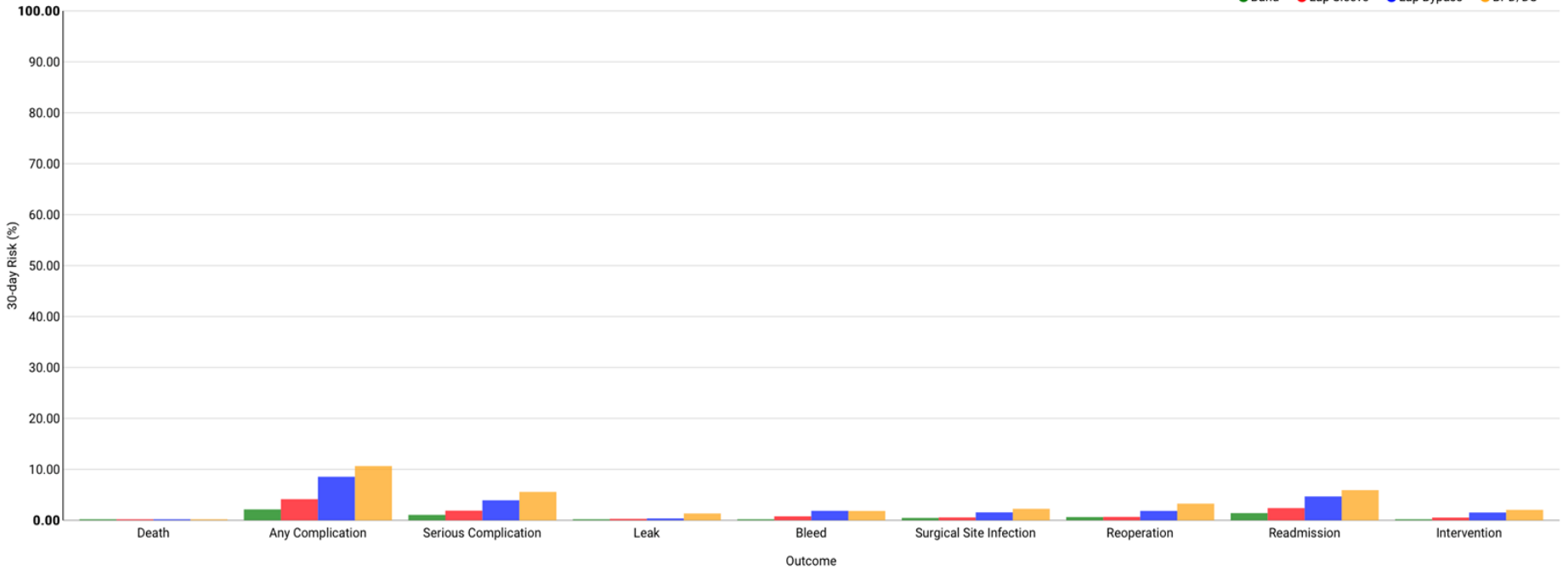
- 30-day Risk
- 1-year BMI
- 1-year Comorbidity Remission
- Create Report

Risk Factors: 46.59 (BMI), 43.00 (Age), Female, Unknown (Race), Unknown (Hispanic Ethnicity), Severe Systemic Disease, Non-Insulin, HTN, Sleep Apnea, GERD, Hyperlipidemia

### Outcomes ?

View Enlarged Chart

● Band ● Lap Sleeve ● Lap Bypass ● BPD/DS



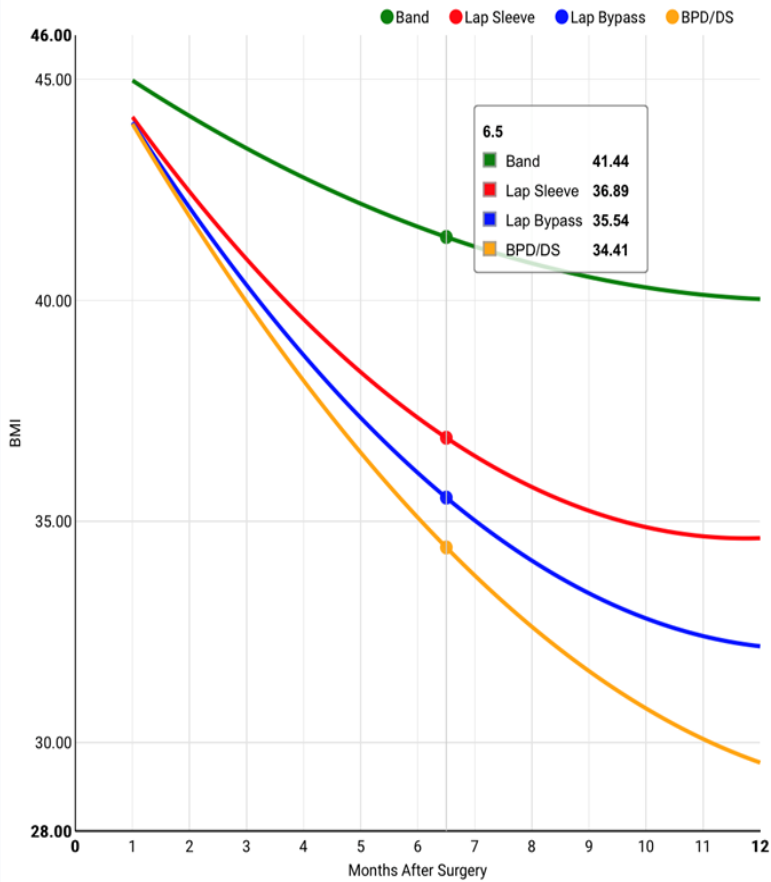


# Bariatric Surgical Risk/Benefit Calculator

## Enter Patient and Surgical Information

### Results

30-day Risk   **1-year BMI**   1-year Comorbidity Remission   Create Report



#### Risk Factors:

46.59 (BMI), 43.00 (Age), Female, Unknown (Race), Unknown (Hispanic Ethnicity), Severe Systemic Disease, Non-Insulin, HTN, Sleep Apnea, GERD, Hyperlipidemia

View:  BMI    Weight Change    Percent Total Weight Change



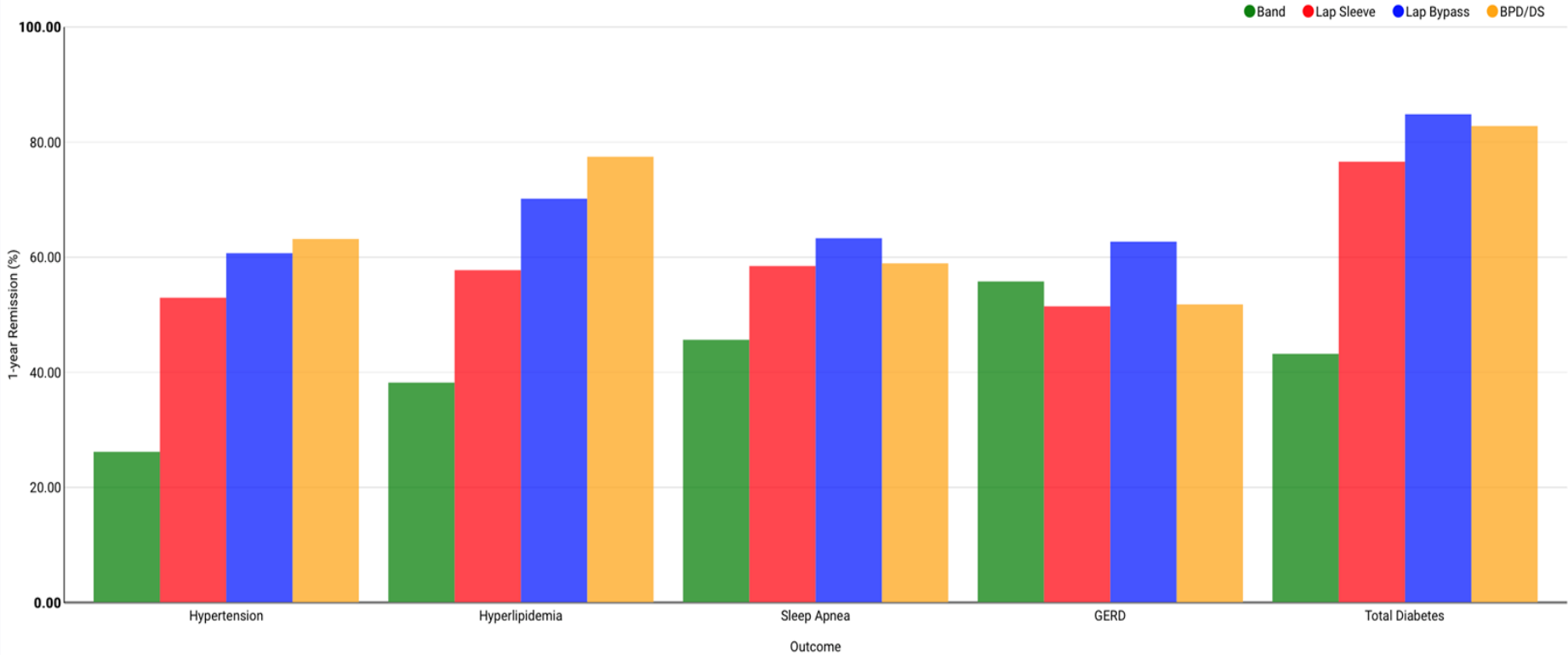
# Bariatric Surgical Risk/Benefit Calculator



Enter Patient and Surgical Information

Results

30-day Risk   1-year BMI   **1-year Comorbidity Remission**   Create Report



# SURGICAL RISK

## Morbidity

- Hysterectomy
  - 5%
- Lap Cholecystectomy
  - 5%
- Elective CABG
  - 15%
- **Bariatric Surgery**
  - **3%**

## Mortality

- Hysterectomy
  - 0.1-0.6 %
- Lap Cholecystectomy
  - 0.2-0.4%
- Elective CABG
  - 0.8-3%
- **Bariatric Surgery**
  - **0.1-0.3%**



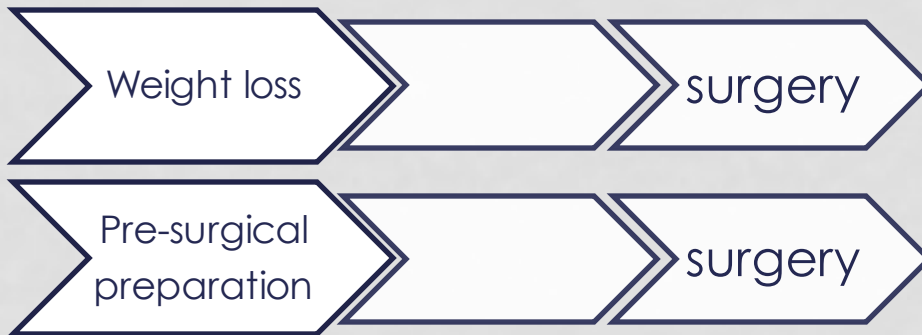
# FACILITATING THE PROCESS

## Weight loss

- Benefit
  - Based on amount
- Insurance obstacle
  - Based on time

## Preparation

- Smoking cessation
- Sleep study
- Endoscopy
- Nutrition classes
- Psychologic eval
- Other evals:
  - Cardiology
  - Pulmonology



# VITAMINS REQUIRED

- MVI Bariatric Specific or 2 X normal dosage
- Calcium Citrate 1500-1800mg, divided TID
- Vit D 3000 IU/day, maybe more
- Vit B12 500-1000 mcg/day (Can be given IM)
- Vit B1 Make sure MVI includes B1
- Iron Typically 65mg elemental iron qd or qod
- Copper, Zinc Usually not supplemented unless deficiency suspected

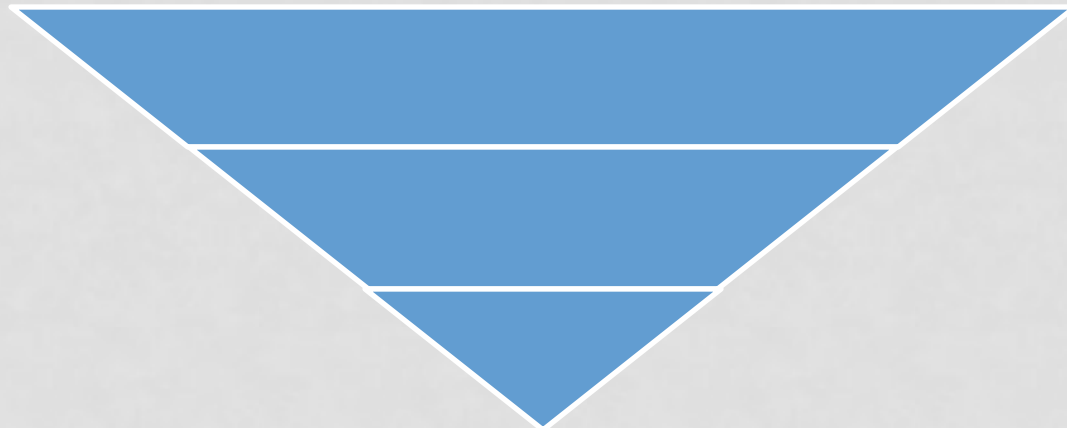
# ANNUAL LABS

- CBC
- CMP
- Ferritin
- Lipids
- PTH
- 25 hydroxyl Vit D
- B1
- B12
- Folate
- TSH
- HbA1c

# DIETARY SUPPORT

- Pre-surgical
- Post-surgery
- Fruit & Veggies
- Lean Meats
- Low fat dairy

Protecting Lean Muscle Mass



# WEIGHT REGAIN

- Goal: at least 50% excess weight
- Weight regain is expected
  - Factors:
    - Anatomic
    - Genetic
    - Dietary
    - Psychiatric



Self Directed Lifestyle Change

Professionally-directed Lifestyle Change

Pharmacotherapy

Weight Loss Surgery

**Post Surgical  
Combinations**

# PEARLS

FROM YOUR FRIENDLY BARIATRIC SURGEON



# POST BARIATRIC SURGERY OUT PATIENT CARE

- Usually do not need to split, crush tablets or change to liquids forms to tolerate.
- May have to titrate dose to effect due to differences in bioavailability after surgery.
- Newer drugs (and many older drugs) have not been tested specifically in bariatric surgery patients so may need to presume that can be some level of altered absorption/bioavailability.

# DOACS

- Most are absorbed early in GI tract (stomach and proximal small intestine)
- Consider based on therapeutic urgency use of vitamin-K antagonists: warfarin
- If using DOACs, should be monitoring levels to ensure therapeutic
  - ↓Quantitative: pt and ptt
  - ↑Qualitative: mass spectrometry and anti-factor Xa levels

# PROTON PUMP INHIBITORS

- Assume some altered bioavailability
- Best to prescribe in dissolvable forms or capsules that can be emptied for taking
- Can be given in higher doses
- Switching to different PPI has been helpful for some
- Often used empirically after surgery for up to 3-6 months to prevent ulcers, etc.
- After that, usual indications (symptoms or prophylaxis)

# EXTENDED RELEASE MEDICATIONS

- May need to change to immediate release medications
- Don't always have to change medication
- Lopressor is a good example
  - The extended-release form of Lopressor has lower bioavailability
  - Usually switched to immediate-release form in early postop period
- Generally, should not crush, chew, split, empty controlled/extended-release medications due to potential for increased bioavailability

# NSAIDS AND STEROIDS

- By the book, **contraindicated** in bariatric surgery patients due to risks for ulcer
  - 1<sup>st</sup> sign of ulcer may be **perforation** or **life-threatening bleeding**
  - Always a risk/benefit question when deciding to use
- Commonly used in **Gastric Sleeve** patients without much hesitation
- If giving, especially in gastric bypass patients:
  - Use lowest possible dose of NSAID/Steroid
  - Use ulcer prophylaxis medications
    - PPIs, H2 blockers, sucralfate, misoprostol

# DIABETES DE-ESCALATION

- inconsistent oral intake
- drastically reduced insulin/medication requirements
- Caution with metformin and SGLT2 (gliflozins)
  - Risk of ketoacidosis is low but significant
  - Likely patients on insulin therapy prior to surgery at most risk
- Emphasis on avoiding hypoglycemia
  - Some tolerance for higher glucoses due to this goal
  - 180 seems to be reasonable in the early postop per

# INPATIENT CONSIDERATIONS HISTORY OF BARIATRIC SURGERY

- No blindly-placed Nasogastric tubes (NGTs)
  - Use fluoroscopy to place Nasogastric tubes
  - Rarely used after bariatric surgery
- Thiamine
  - Make this a standard order (100-200mg Thiamine IV daily)
  - If symptomatic, start with high dose thiamine replacement (500mg Thiamine IV q 8 hours)
  - Don't wait for level
  - Rapid glucose administration can worsen. Check glucose level first for obtunded patients if Thiamine deficiency if possible

# INPATIENT CONSIDERATIONS

- See previous cautions regarding NSAIDs/Steroids
- Treat dehydration AND break ketosis (add D5)
- Respect the diet
  - Use the dietitian or consult bariatric surgeon



