Dealing with **weight regain** after Roux-en-Y gastric bypass: surgical approach

Robin Blackstone, MD, FACS  
Masters of Minimally Invasive Bariatric Surgery  
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Disclosures

• PI Enteromedics VBLOC and Recharge Trials
• Consulting Johnson and Johnson/Ethicon Surgical
Changing Semantics

• Remission of weight
• Partial Remission of weight
• Weight regain

• ELIMINATE THE WORD FAILURE....
Weight Loss after RYGB is Widely and Normally Distributed

Figure 2. Frequency Distribution of Percentage Weight Change From Baseline to 2-Year and 6-Year Follow-up Examinations

The percentages of participants in the gastric bypass surgery group are shown grouped by 5% of unadjusted baseline weight loss intervals at the 2-year and 6-year follow-up examinations.
Bariatric Surgery

Evidence for Physiological Mechanisms

1. Dramatic effects on hunger and satiety
2. Few patients become underweight after surgery
3. Transient weight gain during pregnancy
4. Little or no weight loss in thin patients or animals
5. Changes in GI endocrine markers – ghrelin, PYY, GLP-1, amylin
6. Increased energy expenditure (bypass procedures)
7. Ability to reverse effects of surgery with drugs and genetic manipulation
Anatomic Dissection of RYGB
Gastric Bypass: Five Operations

5. Partial vagotomy
Gastric Bypass: Five Operations

1. Isolation of gastric cardia
Gastric Bypass: Five Operations

2. Exclusion of distal stomach
Gastric Bypass: Five Operations

3. Exclusion of duodenum and proximal jejunum
Gastric Bypass: Five Operations

4. Exposure of distal intestine to undigested nutrients
Altering the “Set Point” with Gastric Surgery

Baseline Energy Expenditure
Baseline Energy Intake
Post-op Energy Intake
Post-op Energy Expenditure

Body Mass Index (kg/m²)

kcal / 24 hours

2000
2500
3000
3500
4000
4500
RYGB: Resolution of the “Overfed” State

- Body Mass Index (kg/m²)
- Post-op Energy Intake
- Post-op Energy Expenditure

Overfed state
RYGB Mimics the Overfed State

Resolution of the overfed state

Body Weight (g)

Days

Overfed

Control

Food Restricted
RYGB Mimics the Overfed State

Resolution of the overfed state

Body Weight (g)

Days

Control
Food Restricted

OLD model of RYGB
CURRENT model of RYGB
Set Point and Weight Regain

Aging and environmental influences (no intervention)

Surgery

Environmental influences and aging

Fat Mass Set Point

Time (years)
RYGB Induces Weight Loss in Mice

RYGB Reduces Nutrient Intake

RYGB Selectively Reduces Body Fat

RYGB Does Not Alter Caloric Absorption

Stool Calorimetry

RYGB Increases Energy Expenditure

Sham

RYGB

Weight-matched

* p<0.05

** p<0.001

GI Endocrine Responses to RYGB

GLP-1

\[ \text{Active GLP-1 (pg/ml)} \]

\[ \text{Time after start of meal (min)} \]

PYY

\[ \text{PYY (pg/ml)} \]

\[ \text{Time after start of meal (min)} \]

Amylin

\[ \text{Active Amylin (pg/ml)} \]

\[ \text{Time after start of meal (min)} \]

Ghrelin

\[ \text{Acylated Ghrelin (pg/ml)} \]

\[ \text{Time after start of meal (min)} \]

GIP

\[ \text{GIP (pg/ml)} \]

\[ \text{Time after start of meal (min)} \]

GLP-1 levels in human after RYGB

## Endocrine Effects of GI Manipulations

<table>
<thead>
<tr>
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<th>Ghrelin</th>
<th>GLP-1</th>
<th>PYY</th>
<th>GIP</th>
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<td>⇔</td>
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<td><strong>Sleeve gastrectomy</strong></td>
<td>↓</td>
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<td><strong>Gastric Bypass</strong></td>
<td>Decreased Initially</td>
<td>↑*</td>
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<td><strong>BPD/DS</strong></td>
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*Post-prandial*
Clinical Predictors of RYGB Weight Loss

Associations with more modest weight loss

- Increased preoperative BMI
- Presence of T2DM
  - Duration of T2DM
  - ? Relationship with b-cell failure
- Lack of physical activity
- Increased patient age
- Inadequate surgical “restriction”
  - Pouch size
  - Diameter of gastro-jejunal anastomosis
- Lack of patient follow-up / compliance
- None of these predictors is sufficiently powerful to determine clinical practice
Carbohydrate eating leads to weight regain

• When a post GBP patient eats any simple sugar (carbohydrates: rice, pasta, bread, potatoes) then evoke a very strong GLP1 response

• The GLP1 drives the release of insulin which outlasts the simple sugar in the blood causing a relative low blood sugar which drives eating

• This occurs over and over all day with subsequent weight regain
Intensive Medical/Behavioral Therapy

• STOP eating any carbs except in green vegetables
• Need to increase energy expenditure and drive body fat percent below 30% in order to reengage the LEPTIN coupling with metabolism (good evidence for Leptin resistance at Body Fat >30%)
• Get the original set of parameters to work for the patient
So what is there to revise?

• Possible options:
  – Revise the gastrojejunostomy
  – Take out the distal remnant (decrease ghrelin)
  – Lengthen the Roux limb
  – Convert to Sleeve/ Duodenal switch
THANK YOU