Bariatric Surgery: How complex is this?

Pradeep Pallati, MD, FACS, FASMBS
Nothing to Disclose
Types of Bariatric Surgery

- Restrictive
- Malabsorptive
- Combination Restrictive and Malabsorptive
- Newer Endoluminal Procedures
Types of Bariatric Surgery

Restrictive

- Vertical Banded Gastroplasty
- Adjustable Gastric Banding
- Sleeve Gastrectomy
Restrictive Procedures

Vertical Banded Gastroplasty

• A small gastric pouch is created using both staples and band

• Staples are used to partition the vertical portion of the stomach and a band is used in the lower portion to create a narrow opening and give the restriction.

• The band is not adjustable
Restrictive Procedures

Vertical Banded Gastroplasty

- Staple line disruption 27-48%
- Stomal stenosis 20-33%
- Band erosion 1-7%
- GERD, weight regain and longterm inadequate weight loss
Adjustable Gastric Banding

- The adjustable gastric band is a silicone belt with an inflatable balloon in the lining that is buckled into a closed ring around the upper stomach.

- A reservoir port is placed under the skin for adjustments to the stoma size.
Restrictive Procedures

Sleeve Gastrectomy

• It involves resection of the major part of the fundus and body of the stomach starting around 6cm proximally from the pylorus
Jejunoileal Bypass

- The proximal jejunum is divided 14 inches from Ligament of Treitz and anastomosed to terminal ileum 4 inches proximal to ileocecal valve

- Severe electrolyte, nutrient and vitamin deficiencies

- Protein-Energy Malnutrition with alopecia and liver failure

- Renal oxalate urolithiasis

- Polyarthropathy
Types of Bariatric Surgery

Combination Restrictive and Malabsorptive

- Roux-en-Y Gastric Bypass
- Mini Gastric Bypass
- Bilio-Pancreatic Diversion with Duodenal Switch (BPD-DS)
Combination Procedures

Roux-en-Y Gastric Bypass

- A small proximal pouch is created out of the larger stomach
- Gastric pouch is bypassed into a Roux limb
- Jejuno-jejunostomy distally provides for diversion of food from digestive juices for around 1/3 bowel
Combination Procedures

Mini-Gastric Bypass

- Much larger stomach pouch is created similar to sleeve gastrectomy
- Instead of Roux-en-y configuration, loop gastro-jejunostomy is created around 200 - 250cm length.
Combination Procedures

BPD-DS

• standard sleeve

• Duodenum is divided distal to the pylorus & anastomosed to ileum 250cm proximal to ileocecal valve

• The bilio-pancreatic limb is anastomosed to ileum 100cm from the ileocecal valve

• The common channel is only 100cm resulting in significant malabsorption
Endo-luminal Procedures

• Intragastric Balloon (Orbera, Apollo surgery; ReShape Duo, ReShape Medical Inc. & Obalon Balloon system, Obalon Therapeutics, Inc.)

• FDA approved for Obese patients with BMI 30-40 Kg/m2

• Typically filled with 400-700mL of fluid

• Even unto 900mL in the dual balloons

• Should be removed 6 months later

• 20-40% Excess weight loss (6.6% - 10% of body weight compared to 3.3% with placebo)
Bariatric Surgery in 2015

- Sleeve gastrectomy: 48%
- Roux-en-Y gastric bypass: 42%
- Laparoscopic adjustable gastric banding: 8%
- Biliopancreatic diversion with duodenal switch: 2%
Bariatric Surgery: Short and Long term Complications

Pradeep Pallati, MD, FACS, FASMBS
Short-term Complications

Serious complications

- leak
- Stricture
- Hemorrhage
- portal venous thrombosis
Short-term Complications

Leak

- Mostly at the angle of His after sleeve gastrectomy
- Usually there is an associated stricture distally
- Managed conservatively with adequate drainage, endoscopic stents and nutrition
Short-term Complications

**Stricture**

- Near the incisor in sleeve gastrectomy
- At the gastrojejunal anastomosis in bypass
- Managed conservatively with endoscopic dilation and in difficult cases, with stenting
Short-term Complications

Hemorrhage

- Along the staple lines in both sleeve and gastric bypass
- Decreased with staple line reinforcement and intra-operative fibrin sealant
- Managed with transfusion and rarely surgical evacuation
Short-term Complications

Venous thromboembolism

- DVT (0.22%), PE (0.2%) & Portal vein thrombosis (0.04%)
- PVT usually presents as abdominal pain 1-4 weeks after sleeve gastrectomy
- Can potentially result in intestinal gangrene
- Only known risk factor is h/o prior DVT

From Michigan Bariatric Surgery Collaborative
## Short-term Complications

### Medical complications

- **UTI**  
  - 0.67%
- Pneumonia or intubation >48 hrs  
  - 0.55%
- Cardiac events  
  - 0.05%
- Renal failure  
  - 0.08%
- C *diff* infection  
  - 0.16%
### Sleeve Gastrectomy Complications

<table>
<thead>
<tr>
<th>Outcome</th>
<th>% of patients (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Any complication</strong></td>
<td>5.4 (5.0–5.9)</td>
</tr>
<tr>
<td>Potentially life-threatening</td>
<td>1.5 (1.3–1.8)</td>
</tr>
<tr>
<td>Staple line Leak</td>
<td>0.46 (0.33–0.63)</td>
</tr>
<tr>
<td>Stricture</td>
<td>0.28 (0.18–0.41)</td>
</tr>
<tr>
<td>Small bowel obstruction</td>
<td>0.06 (0.02–0.13)</td>
</tr>
<tr>
<td>Ulcer</td>
<td>0.05 (0.01–0.12)</td>
</tr>
<tr>
<td>Hemorrhage (requiring transfusion)</td>
<td>1.6 (1.3–1.8)</td>
</tr>
<tr>
<td>Abdominal abscess</td>
<td>0.36 (0.24–0.51)</td>
</tr>
<tr>
<td><strong>Medical complications</strong></td>
<td></td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>0.67 (0.51–0.86)</td>
</tr>
<tr>
<td>Respiratory (pneumonia or intubation &gt;48 hours)</td>
<td>0.55 (0.41–0.73)</td>
</tr>
<tr>
<td>Venous thromboembolism</td>
<td>0.28 (0.18–0.41)</td>
</tr>
<tr>
<td>Cardiac event</td>
<td>0.05 (0.01–0.12)</td>
</tr>
<tr>
<td>Renal failure</td>
<td>0.08 (0.03–0.17)</td>
</tr>
<tr>
<td>Clostridium difficile infection</td>
<td>0.16 (0.09–0.27)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Overall (%)</th>
<th>Laparoscopic Adjustable Gastric Band (n = 3985)</th>
<th>Sleeve Gastrectomy (n = 854)</th>
<th>Gastric Bypass (n = 3047)</th>
<th>P Value&lt;sup&gt;6&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any complication</td>
<td>7.3 (3.9-7.7)</td>
<td>2.3 (1.6-2.5)</td>
<td>8.8 (6.2-7.4)</td>
<td>10.8 (7.1-13.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Non-life-threatening</td>
<td>4.7 (4.6-6.1)</td>
<td>2.0 (1.2-2.8)</td>
<td>7.0 (4.8-7.3)</td>
<td>4.7 (4.6-7.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Potentially life-threatening</td>
<td>3.3 (2.5-4.2)</td>
<td>1.0 (0.5-1.5)</td>
<td>2.2 (1.3-3.2)</td>
<td>3.1 (2.5-3.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Permanently disabling</td>
<td>0.2 (0.1-0.3)</td>
<td>0.0 (0.0-0.1)</td>
<td>0</td>
<td>0.3 (0.2-0.7)</td>
<td>&lt;0.001</td>
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<tr>
<td>Fatal</td>
<td>0.1 (0.0-0.2)</td>
<td>0.0 (0.0-0.1)</td>
<td>0</td>
<td>0.1 (0.0-0.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Combined severe</td>
<td>0.3 (0.2-0.5)</td>
<td>0.3 (0.2-0.5)</td>
<td>0.5 (0.3-0.8)</td>
<td>0.8 (0.3-1.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Complications&lt;sup&gt;6&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Surgical site</td>
<td>3.4 (1.7-6.3)</td>
<td>1.7 (1.4-2.1)</td>
<td>2.6 (2.1-3.1)</td>
<td>1.8 (1.0-3.3)</td>
<td>&lt;0.001</td>
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<tr>
<td>Leak perforation</td>
<td>0.5 (0.4-1.1)</td>
<td>0.0 (0.0-0.1)</td>
<td>0.0 (0.0-0.1)</td>
<td>0.0 (0.0-0.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Anastomosis leak</td>
<td>0.8 (0.6-1.1)</td>
<td>0.0 (0.0-0.1)</td>
<td>0</td>
<td>0.4 (0.2-0.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Retraction/other leak</td>
<td>0.2 (0.1-0.4)</td>
<td>0</td>
<td>0.6 (0.3-1.1)</td>
<td>0.3 (0.1-0.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Dilation</td>
<td>1.5 (1.0-2.5)</td>
<td>1.5 (1.0-2.5)</td>
<td>4.7 (3.2-6.6)</td>
<td>2.4 (1.6-3.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Small bowel obstruction</td>
<td>0.8 (0.4-1.4)</td>
<td>0</td>
<td>0.3 (0.1-0.6)</td>
<td>0.3 (0.1-0.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bowel obstruction</td>
<td>1.1 (0.6-2.0)</td>
<td>2.6 (1.4-4.4)</td>
<td>2.5 (1.8-3.5)</td>
<td>1.6 (1.0-2.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Infection</td>
<td>6.2 (5.3-7.2)</td>
<td>1.3 (0.8-1.8)</td>
<td>7.0 (5.7-8.3)</td>
<td>9.0 (7.5-10.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Abdominal abscess</td>
<td>0.4 (0.3-0.6)</td>
<td>0.0 (0.0-0.1)</td>
<td>0.0 (0.0-0.1)</td>
<td>0.3 (0.2-0.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Wound complications</td>
<td>0.7 (0.4-1.1)</td>
<td>0.0 (0.0-0.1)</td>
<td>0.0 (0.0-0.1)</td>
<td>0.3 (0.2-0.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Port site infection</td>
<td>0.3 (0.2-0.5)</td>
<td>0.0 (0.0-0.1)</td>
<td>0</td>
<td>0.5 (0.3-0.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>1.2 (0.8-1.7)</td>
<td>0.0 (0.0-0.1)</td>
<td>0.6 (0.4-1.0)</td>
<td>0.7 (0.3-1.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Medical complication</td>
<td>1.2 (0.7-1.7)</td>
<td>0.0 (0.0-0.1)</td>
<td>1.0 (0.5-1.6)</td>
<td>1.1 (0.6-1.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Various thromboembolism</td>
<td>0.3 (0.2-0.4)</td>
<td>0.1 (0.0-0.1)</td>
<td>0.4 (0.2-1.6)</td>
<td>0.3 (0.2-0.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cardiac</td>
<td>2.1 (1.8-2.5)</td>
<td>1.1 (0.7-1.5)</td>
<td>2.1 (1.6-2.6)</td>
<td>2.1 (1.6-2.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Renal failure</td>
<td>0.2 (0.1-0.4)</td>
<td>0.0 (0.0-0.1)</td>
<td>0</td>
<td>0.4 (0.2-0.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Respiratory</td>
<td>0.9 (0.6-1.3)</td>
<td>0.0 (0.0-0.1)</td>
<td>0.0 (0.0-0.1)</td>
<td>0.1 (0.0-0.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Citations</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Adhesion</td>
<td>4.7 (3.3-6.1)</td>
<td>3.0 (2.4-3.6)</td>
<td>3.4 (2.9-4.0)</td>
<td>2.5 (2.3-2.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Readmission</td>
<td>4.0 (3.7-4.4)</td>
<td>2.0 (1.6-2.4)</td>
<td>8.6 (7.7-9.6)</td>
<td>8.6 (7.6-9.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Transfer</td>
<td>0.14 (0.10-0.20)</td>
<td>0.0 (0.0-0.1)</td>
<td>0.0 (0.0-0.1)</td>
<td>0.2 (0.1-0.3)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Abbreviation: CI, confidence interval; P, values were calculated using chi-square test.
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Complication Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABG</td>
<td>46.6%</td>
</tr>
<tr>
<td>Infrainguinal Bypass</td>
<td>23.6%</td>
</tr>
<tr>
<td>Knee Arthroplasty</td>
<td>16.7%</td>
</tr>
<tr>
<td>Lap Colectomy</td>
<td>12.0%</td>
</tr>
<tr>
<td>Lap Appendectomy</td>
<td>4.5%</td>
</tr>
<tr>
<td>Lap Cholecystectomy</td>
<td>3.7%</td>
</tr>
<tr>
<td>Lap Hysterectomy</td>
<td>3.5%</td>
</tr>
<tr>
<td>LRYGB</td>
<td>3.4%</td>
</tr>
</tbody>
</table>

Comparative Mortality Trends

General surgical operations, 2008-2012

Nguyen et al, SOARD 2012
Mortality Trends

Bariatric Surgery In-hospital Mortality by Year 2002-2009
(N = 105,287)

Deaths per 1,000

Year

2002  2003  2004  2005  2006  2007  2008  2009

4.0  2.6  2.3  1.6  1.5  1.0  0.8  0.6

Nguyen et al, SOARD 2012
Long term Complications

• Ventral hernia

• Intestinal obstruction
  • Adhesions
  • Internal hernia 3.0 - 4.5%

• Anastomotic stricture 5 - 27%

• Marginal Ulcer 1 - 16%

• Gallstones 2 - 20%
Long term Complications

- Nutrient deficiencies
- Alcohol Use Disorder 7.6% 9.6%
- Dumping syndrome
  - Early (hypovolemic) - sweating, palpitations, drowsiness, and the need to lie down ~ 19%
  - Late (hypoglycemia) - sweating, drowsiness, trembling, or even coma ~ 12%
- Nephrolithiasis
  - Increased risk with gastric bypass - RR of 1.73 (95% CI, 1.30-2.30)
  - Decreased risk with sleeve and Banding - RR of 0.37 (95% CI, 0.16-0.85)
- Depression - increased risk in patients with underlying depression prior bariatric surgery
Bariatric Surgery: When is the best time for the surgery

Pradeep Pallati, MD, FACS, FASMBS
# Impact of Gastric Bypass Operation on Survival: A Population-Based Analysis


<table>
<thead>
<tr>
<th></th>
<th>No Surgery</th>
<th>Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>15 year Mortality</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All ages</td>
<td>16.3%</td>
<td>11.8%</td>
</tr>
<tr>
<td>Under 40</td>
<td>13.8%</td>
<td>3%</td>
</tr>
</tbody>
</table>
Impact of bariatric surgery on life expectancy in severely obese patients with diabetes: A Decision analysis

Daniel P. Schauer, MD, MSc¹, David E. Arterburn, MD, MPH², Edward H. Livingston, MD³,
Karen J. Coleman, Ph.D.⁴, Steve Sidney, MD, MPH⁵, David Fisher, MD⁵, Patrick O’Connor,
MD, MA, MPH⁶, David Fischer, MD⁷, and Mark H. Eckman, MD, MS¹

- 45 year-old female with diabetes and a BMI of 45 kg/m², and no h/o HTN, CAD or CHF, would gain 6.7 additional years of life expectancy with bariatric surgery (38.4 yrs vs. 31.7 yrs)

- 45 year-old female with a BMI of 45 kg/m² and HTN, CAD or CHF would be expected to have much shorter life expectancy but would still gain 6.7 additional years of life expectancy (22.3 yrs vs. 15.6 yrs)

- A 45 year-old male with diabetes and a BMI of 45 kg/m², and no h/o HTN, CAD or CHF, also gained an additional 6.5 years of life expectancy with bariatric surgery (33.7 yrs vs. 27.2 yrs)

- A 45 year-old male with a BMI of 45 kg/m² and HTN, CAD or CHF would gain 5.4 years of life expectancy (17.0 yrs vs. 11.6 yrs)
Timing of bariatric surgery in people with obesity and diabetes

Luca Busetto

Department of Medicine, Centre for the Study and the Integrated Management of Obesity, University of Padua, Padua, Italy

Correspondence to: Dr. Luca Busetto, Clinica Medica 3. Azienda Ospedaliera di Padova. Via Giustiniani 2. 35128 Padova, Italy. Email: luca.busetto@unipd.it.

Prediabetes

• Well documented, highly significant reduction of new cases of type 2 diabetes

Recently onset type 2 diabetes

• Well documented high potential for diabetes remission; documented reduction in the incidence of macro- and micro-vascular complications

Type 2 diabetes with initial macro- and micro-vascular complications

• Possible regression of macro- and micro-vascular complication suggested in some study

Type 2 diabetes with established end-stage macro- or micro-vascular complications

• No regression and in some cases progression of micro-vascular complications (diabetic nephropathy and retinopathy); no gain in survival
Questions?