Bariatric Surgery
Relevant Disclosure and Resolution

Under Accreditation Council for Continuing Medical Education guidelines disclosure must be made regarding relevant financial relationships with commercial interests within the last 12 months.

Laura Fischer MD MS

I have no relevant financial relationships or affiliations with commercial interests to disclose.
Bariatric Surgery

- What is obesity?
- Why don’t diet & exercise work?
- What is bariatric surgery?
- What are the outcomes after bariatric surgery?
- How does our weight loss program work?
Case Study – Patient JT

- 70M, BMI 41.4 (313 lbs)
- Hypertension (2006) – Carvedilol, Lisinopril
- DM II (2009) – A1c 11.7% on Metformin, Levemir, & Humalog
- Obstructive sleep apnea – compliant with CPAP
- CHF (2015) – Lasix, aspirin
  - LVEF 50-55%
  - LVH
  - Grade I diastolic dysfunction
- Renal insufficiency – Cr 1.5, GFR 47
- Osteoarthritis – multiple knee injections, daily Ibuprofen
Global Obesity

1.9 BILLION overweight (39%)

600 MILLION obese (13%)

Global Burden Of Disease Study (1990-2010)

• Declining mortality →
  – Communicable diseases
  – Maternal / Neonatal
  – Nutritional causes

• Increasing mortality →
  – Cancer 8 million deaths, 38% increase
  – Cardiovascular disease 12.9 million deaths, 1 in 4 worldwide
  – Diabetes 1.3 million deaths, 100% increase

Obesity in the United States (2015)

- 70.7% overweight
- 37.9% obese

## Obesity in Oklahoma

<table>
<thead>
<tr>
<th>Rank</th>
<th>State</th>
<th>Percentage of Adult Obesity (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Louisiana</td>
<td>36.2 (+/-1.9)</td>
</tr>
<tr>
<td>2</td>
<td>Alabama</td>
<td>35.6 (+/-1.5)</td>
</tr>
<tr>
<td>2</td>
<td>Mississippi</td>
<td>35.6 (+/-1.9)</td>
</tr>
<tr>
<td>2</td>
<td>West Virginia</td>
<td>35.6 (+/-1.5)</td>
</tr>
<tr>
<td>5</td>
<td>Kentucky</td>
<td>34.6 (+/-1.7)</td>
</tr>
<tr>
<td>6</td>
<td>Arkansas</td>
<td>34.5 (+/-2.3)</td>
</tr>
<tr>
<td>7</td>
<td>Kansas</td>
<td>34.2 (+/-0.8)</td>
</tr>
<tr>
<td>8</td>
<td>Oklahoma</td>
<td>33.9 (+/-1.7)</td>
</tr>
<tr>
<td>9</td>
<td>Tennessee</td>
<td>33.8 (+/-1.9)</td>
</tr>
<tr>
<td>10</td>
<td>Missouri</td>
<td>32.4 (+/-1.6)</td>
</tr>
<tr>
<td>10</td>
<td>Texas</td>
<td>32.4 (+/-1.5)</td>
</tr>
</tbody>
</table>

Note: For rankings, 1 = Highest rate of obesity. C.I. = Confidence Intervals.
What is obesity?

Excess fat storage

75-100 lbs overweight

Morbid Obesity

Obesity-related health problems
Obesity-related Health Problems

- Diabetes, type II
- Hypertension
- Coronary artery disease
- Stroke
- Hyperlipidemia
- Non-alcoholic fatty liver disease (NAFLD)
- Gallstones
- Osteoarthritis
- Degenerative joint disease
- Gastroesophageal reflux (GERD)

- Obstructive sleep apnea
- Pulmonary hypertension
- Cancer
  - Esophageal
  - Pancreatic
  - Breast
  - Endometrial
  - Ovarian
  - Cervical
  - Prostate
  - Renal cell
  - Colon
Obesity-related Psychological Problems

- Decreased self-esteem
- Depression
- Anxiety
- Social discrimination
- Social Anxiety Disorder
- Binge Eating Disorder
- Night-time Eating Syndrome
Body Mass Index (BMI)

Weight (kg) x Height (m)^2
Body Mass Index (BMI)

• Overweight  \[ \text{BMI} \geq 25 \]

• Obese  \[ \text{BMI} \geq 30 \]
  – Class 1  \[ 30-34.9 \]
  – Class 2  \[ 35-39.9 \]
  – Class 3  \[ 40+ \]
Causes of Obesity

- Genetics
- Economics
- Medications
- Environment
- Emotional & Psychological Triggers
Obesity – Excessive Free Fatty Acids

• Excessive FFA due to increased lipolysis
• Creates oxidative stress on all cells
  – Liver
  – Pancreas
  – Circulatory system
• Inhibit lipogenesis $\rightarrow$ decr clearance of triacylglycerol $\rightarrow$ hypertriglyceridemia
• Insulin receptor dysfunction $\rightarrow$ insulin-resistant state $\rightarrow$ hyperglycemia
• Decrease utilization of insulin-stimulated muscle glucose $\rightarrow$ hyperglycemia
• Decreases secretion of pancreatic $\beta$-cell insulin $\rightarrow$ $\beta$-cell exhaustion

Obesity → Inflammation

Diet & Exercise DO NOT WORK!

Hypothalamic set point → Metabolic adaptation

- Leptin ↓ / ghrelin ↑
- Accelerated fat storage
- Decreased skeletal muscle thermogenesis
Diet & Exercise DO NOT WORK!

Metabolic adaptation relative to weight loss when dieting

Diet & Exercise DO NOT WORK!

Persistence of metabolic adaptation even after return to an energy balanced diet

After ‘The Biggest Loser,’ Their Bodies Fought to Regain Weight

Contestants lost hundreds of pounds during Season 8, but gained them back. A study of their struggles helps explain why so many people fail to keep off the weight they lose.
# Persistent Metabolic Adaptation 6 Years After “The Biggest Loser” Competition

*Erin Fothergill¹, Juen Guo¹, Lilian Howard¹, Jennifer C. Kerns², Nicolas D. Knuth³, Robert Brychta¹, Kong Y. Chen¹, Monica C. Skarulis¹, Mary Walter¹, Peter J. Walter¹, and Kevin D. Hall¹*

<table>
<thead>
<tr>
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<th>Baseline</th>
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<th>6 years</th>
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<tr>
<td>Weight (kg)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
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<td></td>
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<tr>
<td>% body fat</td>
<td>49</td>
<td></td>
<td></td>
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<tr>
<td>RMR (kcal/d)</td>
<td>2600</td>
<td></td>
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<tr>
<td>Met adapt</td>
<td>29</td>
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</table>
# The Biggest Loser

## Persistent Metabolic Adaptation 6 Years After “The Biggest Loser” Competition


<table>
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<td>BMI</td>
<td>49.5</td>
<td>30.2</td>
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<tr>
<td>% body fat</td>
<td>49</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>RMR (kcal/d)</td>
<td>2600</td>
<td>2000</td>
<td></td>
</tr>
<tr>
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<td>29</td>
<td>-275</td>
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</table>
The Biggest Loser

### Persistent Metabolic Adaptation 6 Years After “The Biggest Loser” Competition

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<tbody>
<tr>
<td>Weight (kg)</td>
<td>328</td>
<td>198</td>
<td>289</td>
</tr>
<tr>
<td>BMI</td>
<td>49.5</td>
<td>30.2</td>
<td>43.8</td>
</tr>
<tr>
<td>% body fat</td>
<td>49</td>
<td>28</td>
<td>44</td>
</tr>
<tr>
<td>RMR (kcal/d)</td>
<td>2600</td>
<td>2000</td>
<td>1900</td>
</tr>
<tr>
<td>Met adapt</td>
<td>29</td>
<td>-275</td>
<td>-499</td>
</tr>
</tbody>
</table>
Bariatric Surgery

What are the options?
Requirements

BMI ≥ 35
+ 1-2 obesity-related health problems

- OR -

BMI ≥ 40
Relative contraindications

- End stage heart failure
- End stage pulmonary disease
- End stage liver failure
- Severe inflammatory bowel disease (Crohn’s)
- Undergoing active cancer treatment
- Poorly controlled psychological disease
- Untreated drug or alcohol abuse
- Unable to walk
- No motivation!
Absolute contraindications

All patients MUST **QUIT** smoking!!!
Surgery Types

Incision for Open Weight Loss Surgery

The incision location, number of incisions and the incision size may vary from surgeon to surgeon.

Incisions for Laparoscopic Weight Loss Surgery

The incision location, number of incisions and the incision size may vary from surgeon to surgeon.
Roux-en-Y Gastric Bypass (RYGB)

- Restriction + malabsorption
- 60-80% EBW

http://www.weightlossmichigan.com/procedures/laparoscopic_gastric_bypass
Roux-en-Y Gastric Bypass (RYGB)

Advantages

- Excellent weight loss! (60-80% EBW)
- Long-term results (30+ years)
- Excellent hunger control
- Cures acid reflux
- Diabetes resolution (75-80%)
- HTN resolution (75-80%)
- OSA resolution (80%)

http://www.weightlossmichigan.com/procedures/laparoscopic_gastric_bypass
Roux-en-Y Gastric Bypass (RYGB)

Disadvantages

• Complex, 3 hour operation
• Staple line leak (1-2%)
• Staple line stricture (6-8%)
• Marginal ulcer (6-8%)
• Perforation (<1%)
• Internal hernia risk
• No NSAIDs for life
• Malnutrition risk – vitamins for life!

http://www.weightlossmichigan.com/procedures/laparoscopic_gastric_bypass
Sleeve Gastrectomy

• Restriction only

• 50-70% EBW

http://www.weightlossmichigan.com/procedures/laparoscopic_sleeve_gastrectomy
Sleeve Gastrectomy

Advantages

- Short, easy operation, 45 min
- Good weight loss (50-70% EBW)
- Medium-term results (10 years)
- Excellent hunger control
- Better absorption of medications
- Less malnutrition risk
- Can take NSAIDs
- **NO** risk of internal hernia

http://www.weightlossmichigan.com/procedures/laparoscopic_sleeve_gastrectomy
Sleeve Gastrectomy

Disadvantages

• Staple line leak (1-2%)
• Staple line stricture (0.7%)
• Can worsen or cause GERD
• Complications may need conversion to RYGB
• Less resolution of some obesity-related health problems (e.g. DM II)
  – Diabetes resolution (60-70%)
• Concerns for weight regain?

http://www.weightlossmichigan.com/procedures/laparoscopic_sleeve_gastrectomy
Complications

**Short Term**
- Infection
- Bleeding
- Leak
- Stricture
- Marginal Ulcer
- Perforation
- Injury to other organs
- DVT / PE (blood clots)
- Pneumonia / Breathing problems
- Heart attack
- Stroke
- ICU stay
- Death

**Long Term**
- Dehydration
- Constipation
- Abdominal wall hernia
- Kidney stones
- Gallstones
- Internal hernia
- Bowel obstruction
- Acid reflux
- Malnutrition
- Weight regain
- Dumping syndrome
- Alcohol abuse
- Eating disorders
Biliopancreatic Diversion with Duodenal Switch

- Restriction + malabsorption
- 70-90% EBW
- Diabetes resolution 80-90%
- Severe malnutrition risk
- High complication risk

http://www.weightlossmichigan.com/procedures/laparoscopic_duodenal_switch
Adjustable Gastric Band

- Restriction?
- 20% EBW??
- Multiple re-operations
- Trouble swallowing
- Nausea
- Hunger!

http://www.weightlossmichigan.com/procedures/lap_band
Non-surgical alternatives

**ORBERA®**

https://drdirkweightloss.com/procedures/gastric_balloon_procedure/

**ReShape™**

http://www.medgadget.com/2010/02/reshape_inflatable_gastric_balloon_system_going_on_trial_as_weight_loss_option.html

**AspireAssist®**

Weight-loss Medications

- Adverse side-effects
- Expensive
- Must take for life
Outcomes After Laparoscopic Roux-en-Y Gastric Bypass for Morbid Obesity

Philip R. Schauer, MD, Sayeed Ikramuddin, MD, William Gourash, CRNP, Ramesh Ramanathan, MD, and James Luketich, MD


• 275 patients underwent laparoscopic RYGB from 1997-2000
• Single institution
• Retrospective cohort study
• Follow-up 1-3 years
• Outcome measures → mortality, morbidity, QOL
# Outcomes After Laparoscopic Roux-en-Y Gastric Bypass for Morbid Obesity

Philip R. Schauer, MD, Sayeed Ikramuddin, MD, William Gourash, CRNP, Ramesh Ramanathan, MD, and James Luketich, MD


<table>
<thead>
<tr>
<th>Demographics</th>
<th>Co-morbidities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age 42 (17-68)</td>
<td>Hypertension 52%</td>
</tr>
<tr>
<td>Female 81%</td>
<td>Diabetes type II 22%</td>
</tr>
<tr>
<td>White 92%</td>
<td>Hypercholesterolemia 62%</td>
</tr>
<tr>
<td>Mean BMI 48.3 (35-68)</td>
<td>Degenerative joint disease 64%</td>
</tr>
<tr>
<td>Superobese (BMI &gt; 50) 38.5%</td>
<td>GERD 51%</td>
</tr>
<tr>
<td>Cardiopulmonary disease 79%</td>
<td>Obstructive sleep apnea 36%</td>
</tr>
</tbody>
</table>
Outcomes After Laparoscopic Roux-en-Y Gastric Bypass for Morbid Obesity

Mean excess weight loss (EWL)

83.2%

2 years
# Outcomes After Laparoscopic Roux-en-Y Gastric Bypass for Morbid Obesity

## Table 8. CHANGE IN OBESITY-RELATED COMORBIDITY

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>Total</th>
<th>% Aggravated</th>
<th>% Unchanged</th>
<th>% Improved</th>
<th>% Resolved</th>
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</thead>
<tbody>
<tr>
<td>OA/DJD</td>
<td>64</td>
<td>2</td>
<td>10</td>
<td>47</td>
<td>41</td>
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<tr>
<td>Hypercholesterolemia</td>
<td>62</td>
<td>0</td>
<td>4</td>
<td>33</td>
<td>63</td>
</tr>
<tr>
<td>GERD</td>
<td>59</td>
<td>0</td>
<td>4</td>
<td>24</td>
<td>72</td>
</tr>
<tr>
<td>HTN</td>
<td>57</td>
<td>2</td>
<td>12</td>
<td>18</td>
<td>70</td>
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<tr>
<td>Sleep apnoea</td>
<td>44</td>
<td>2</td>
<td>5</td>
<td>19</td>
<td>74</td>
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<tr>
<td>Hypertriglyceridemia</td>
<td>43</td>
<td>0</td>
<td>14</td>
<td>29</td>
<td>57</td>
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<tr>
<td>Depression</td>
<td>38</td>
<td>8</td>
<td>37</td>
<td>47</td>
<td>8</td>
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<tr>
<td>Peripheral edema</td>
<td>31</td>
<td>0</td>
<td>4</td>
<td>55</td>
<td>41</td>
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<tr>
<td>Urinary incontinence</td>
<td>18</td>
<td>0</td>
<td>11</td>
<td>39</td>
<td>44</td>
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<tr>
<td>Asthma</td>
<td>18</td>
<td>6</td>
<td>12</td>
<td>69</td>
<td>13</td>
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<tr>
<td>Diabetes</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>82</td>
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<tr>
<td>Migraine headaches</td>
<td>7</td>
<td>0</td>
<td>14</td>
<td>29</td>
<td>57</td>
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<tr>
<td>Anxiety</td>
<td>7</td>
<td>0</td>
<td>50</td>
<td>17</td>
<td>33</td>
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<td>Venous insufficiency</td>
<td>7</td>
<td>0</td>
<td>71</td>
<td>29</td>
<td>0</td>
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<td>14</td>
<td>72</td>
</tr>
<tr>
<td>CAD</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td>COPD</td>
<td>3</td>
<td>0</td>
<td>33</td>
<td>67</td>
<td>0</td>
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<tr>
<td>CHF</td>
<td>3</td>
<td>0</td>
<td>33</td>
<td>67</td>
<td>0</td>
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<tr>
<td>OHS</td>
<td>2</td>
<td>0</td>
<td>50</td>
<td>50</td>
<td>0</td>
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</table>

CAD, coronary heart disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; GERD, gastroesophageal reflux disease; HTN, hypertension; OA/DJD, osteoarthritis/degenerative joint disease; OHS, obesity hypoventilation syndrome.
Effects of Bariatric Surgery on Mortality in Swedish Obese Subjects

Lars Sjöström, M.D., Ph.D., Kristina Narbro, Ph.D., C. David Sjöström, M.D., Ph.D., Kristjan Karason, M.D., Ph.D., Bo Larsson, M.D., Ph.D., Hans Wedel, Ph.D., Ted Lystig, Ph.D., Marianne Sullivan, Ph.D., Claude Bouchard, Ph.D., Björn Carlsson, M.D., Ph.D., Calle Bengtsson, M.D., Ph.D., Sven Dahlgren, M.D., Ph.D., Anders Gummesson, M.D., Peter Jacobson, M.D., Ph.D., Jan Karlsson, Ph.D., Anna-Karin Lindroos, Ph.D., Hans Löroth, M.D., Ph.D., Ingmar Näslund, M.D., Ph.D., Torsten Olbers, M.D., Ph.D., Kai Stenlöf, M.D., Ph.D., Jarl Torgerson, M.D., Ph.D., Göran Ågren, M.D., and Lena M.S. Carlsson, M.D., Ph.D., for the Swedish Obese Subjects Study


• 4047 obese patients → #2010 surgery – vs - #2037 medical tx
• Prospective, controlled cohort study
• Follow-up 10.9 years
• Follow-up rate 99.9%
• Outcome measure → mortality
Effects of Bariatric Surgery on Mortality in Swedish Obese Subjects

Effects of Bariatric Surgery on Mortality in Swedish Obese Subjects

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Surgery</th>
<th>Medical</th>
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<tbody>
<tr>
<td>All cause</td>
<td>101</td>
<td>129</td>
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<tr>
<td>Cardiac</td>
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<td>44</td>
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<tr>
<td>MI</td>
<td>13</td>
<td>25</td>
</tr>
<tr>
<td>CHF</td>
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<td>5</td>
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<tr>
<td>Sudden death</td>
<td>20</td>
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<td>Cancer</td>
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<td>47</td>
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<tr>
<td>PE</td>
<td>4</td>
<td>7</td>
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</table>

*Figure 2. Unadjusted Cumulative Mortality.*

The hazard ratio for subjects who underwent bariatric surgery, as compared with control subjects, was 0.76 (95% confidence interval, 0.59 to 0.99; P=0.04), with 129 deaths in the control group and 101 in the surgery group.

Effects of bariatric surgery on cancer incidence in obese patients in Sweden (Swedish Obese Subjects Study): a prospective, controlled intervention trial

Long-Term Mortality after Gastric Bypass Surgery

Ted D. Adams, Ph.D., M.P.H., Richard E. Gress, M.A., Sherman C. Smith, M.D.,
R. Chad Halverson, M.D., Steven C. Simper, M.D., Wayne D. Rosamond, Ph.D.,
Michael J. LaMonte, Ph.D., M.P.H., Antoinette M. Stroup, Ph.D.,
and Steven C. Hunt, Ph.D.


- 15,850 obese patients matched on age, gender, BMI
  - 7,925 RYGB
  - 7,925 obese controls

- Retrospective cohort study

- Follow-up 7.1 years

- Outcome measure → rate of death from any cause & specific cause using NDI
Long-Term Mortality after Gastric Bypass Surgery

Table 3. Hazard Ratios for Death in the Surgery Group as Compared with the Control Group.*

<table>
<thead>
<tr>
<th>End Point</th>
<th>All Subjects</th>
<th>Matched Subjects</th>
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<tbody>
<tr>
<td></td>
<td>Hazard Ratio (95% CI)</td>
<td>P Value</td>
</tr>
<tr>
<td>All causes of death</td>
<td>0.63 (0.53–0.74)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>All deaths caused by disease</td>
<td>0.49 (0.41–0.59)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>0.50 (0.36–0.69)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>0.36 (0.20–0.65)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Heart failure</td>
<td>0.38 (0.08–1.82)</td>
<td>0.22</td>
</tr>
<tr>
<td>Stroke</td>
<td>0.52 (0.20–1.34)</td>
<td>0.18</td>
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<tr>
<td>Other cardiovascular disease</td>
<td>0.59 (0.38–0.89)</td>
<td>0.01</td>
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<tr>
<td>Diabetes</td>
<td>0.10 (0.02–0.46)</td>
<td>0.003</td>
</tr>
<tr>
<td>Cancer</td>
<td>0.38 (0.25–0.57)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Other diseases</td>
<td>0.65 (0.48–0.87)</td>
<td>0.005</td>
</tr>
<tr>
<td>All nondisease causes</td>
<td>1.76 (1.19–2.58)</td>
<td>0.004</td>
</tr>
<tr>
<td>Accident unrelated to drugs</td>
<td>1.34 (0.72–2.49)</td>
<td>0.36</td>
</tr>
<tr>
<td>Poisoning of undetermined intent</td>
<td>3.80 (1.29–12.0)</td>
<td>0.02</td>
</tr>
<tr>
<td>Suicide</td>
<td>1.71 (0.69–4.25)</td>
<td>0.25</td>
</tr>
<tr>
<td>Other nondisease cause</td>
<td>1.64 (0.82–3.28)</td>
<td>0.16</td>
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</table>
Effect of Laparoscopic Roux-En Y Gastric Bypass on Type 2 Diabetes Mellitus

Philip R. Schauer, MD,* Bartolome Burguera, MD,† Sayeed Ikramuddin, MD,‡ Dan Cottam, MD,* William Gourash, CRNP,* Giselle Hamad, MD,* George M. Eid, MD,* Samer Mattar, MD,* Ramesh Ramanathan, MD,* Emma Barinas-Mitchel, PhD,§ R. Harsha Rao, MD,† Lewis Kuller, MD DrPH,§ and David Kelley, MD†


• 240 pts with diabetes underwent RYGB
• Retrospective review
• Follow-up about 5 years (80% completion)
• Outcome measure → improvement or resolution of diabetes
Effect of Laparoscopic Roux-En Y Gastric Bypass on Type 2 Diabetes Mellitus

Philip R. Schauer, MD,* Bartolome Burguera, MD,† Sayeed Ikramuddin, MD,‡ Dan Cottam, MD,* William Gourash, CRNP,* Giselle Hamad, MD,* George M. Eid, MD,* Samer Mattar, MD,* Ramesh Ramanathan, MD,* Emma Barinas-Mitchel, PhD,§ R. Harsha Rao, MD,† Lewis Kuller, MD DrPH,§ and David Kelley, MD†


### TABLE 3. Resolution of T2DM According to Preoperative Severity and Duration (n = 191)

<table>
<thead>
<tr>
<th>Severity*</th>
<th>Improved</th>
<th>Resolved</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFG (n = 14)</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>DC-T2DM (n = 32)</td>
<td>3%</td>
<td>97%</td>
</tr>
<tr>
<td>OA-T2DM (n = 93)</td>
<td>13%</td>
<td>87%</td>
</tr>
<tr>
<td>I-T2DM (n = 52)</td>
<td>38%</td>
<td>62%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration*</th>
<th>Improved</th>
<th>Resolved</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤5 years (n = 119)</td>
<td>5%</td>
<td>95%</td>
</tr>
<tr>
<td>6 to 10 years (n = 44)</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>&gt;10 years (n = 28)</td>
<td>46%</td>
<td>54%</td>
</tr>
</tbody>
</table>

* Indicates P < 0.001.

### TABLE 4. Patient Factors and Outcomes Associated With T2DM Resolution (n = 191)

<table>
<thead>
<tr>
<th>Number</th>
<th>Improved</th>
<th>Resolved</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>48.2 ± 8.5</td>
<td>47.8 ± 8.6</td>
<td>0.724</td>
</tr>
<tr>
<td>Gender (% female)</td>
<td>70%</td>
<td>76%</td>
<td>0.615</td>
</tr>
<tr>
<td>Pre-Op BMI (kg/m²)</td>
<td>51 ± 8.6</td>
<td>50 ± 8.4</td>
<td>0.270</td>
</tr>
<tr>
<td>Post-Op BMI (kg/m²)</td>
<td>37 ± 7.8</td>
<td>33 ± 6.7</td>
<td>0.002</td>
</tr>
<tr>
<td>% EWL</td>
<td>42 ± 18</td>
<td>62 ± 17</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pre-op glycated Hb</td>
<td>8.8 ± 1.8</td>
<td>8.1 ± 2.0</td>
<td>0.033</td>
</tr>
<tr>
<td>Pre-op fasting glucose (mg/dl)</td>
<td>189 ± 7.8</td>
<td>183 ± 7.6</td>
<td>0.436</td>
</tr>
<tr>
<td>Duration of diabetes</td>
<td>10.7 ± 6.8</td>
<td>4.1 ± 5.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>% Insulin users preop</td>
<td>63%</td>
<td>23%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Data are percentage, mean ± standard deviation.
STAMPEDE Trial

- Single site, prospective, three-arm randomized controlled trial
- **Sleeve** versus **RYGB** versus **Intensive Medical Therapy (IMT)**
  - Stratified based on insulin usage
  - Age 20-60
  - BMI 27-43
- Enroll 150 patients
- Primary endpoint: Biochemical resolution of T2DM at 1 year as measured by A1c ≤ 6%

## Bariatric Surgery versus Intensive Medical Therapy in Obese Patients with Diabetes

Philip R. Schauer, M.D., Sangeeta R. Kashyap, M.D., Kathy Wolski, M.P.H., Stacy A. Brethauer, M.D., John P. Kirwan, Ph.D., Claire E. Pothier, M.P.H., Susan Thomas, R.N., Beth Abood, R.N., Steven E. Nissen, M.D., and Deepak L. Bhatt, M.D., M.P.H.


<table>
<thead>
<tr>
<th></th>
<th>IMT</th>
<th>RYGB</th>
<th>Sleeve</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1c ≤ 6 with meds</td>
<td>12%</td>
<td>42%</td>
<td>37%</td>
</tr>
<tr>
<td>A1c ≤ 6 without meds</td>
<td>0</td>
<td>42%</td>
<td>27%</td>
</tr>
<tr>
<td>Mean A1c – baseline</td>
<td>8.9 ± 1.4</td>
<td>9.3 ± 1.4</td>
<td>9.5 ± 1.7</td>
</tr>
<tr>
<td>Mean A1c – 12 mo</td>
<td>7.5 ± 1.8</td>
<td>6.4 ± 0.9</td>
<td>6.6 ± 1.0</td>
</tr>
<tr>
<td>Mean weight – baseline</td>
<td>104 ± 14</td>
<td>106 ± 15</td>
<td>101 ± 16</td>
</tr>
<tr>
<td>Mean weight – 12 mo</td>
<td>99 ± 14</td>
<td>77 ± 13</td>
<td>75 ± 13</td>
</tr>
</tbody>
</table>
# Bariatric Surgery versus Intensive Medical Therapy for Diabetes — 3-Year Outcomes


for the STAMPEDE Investigators*

* * *


<table>
<thead>
<tr>
<th></th>
<th>IMT</th>
<th>RYGB</th>
<th>Sleeve</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1c ≤ 6 with meds</td>
<td>5%</td>
<td>38%</td>
<td>24%</td>
</tr>
<tr>
<td>A1c ≤ 6 without meds</td>
<td>0</td>
<td>35%</td>
<td>20%</td>
</tr>
<tr>
<td>Mean A1c – baseline</td>
<td>9.0 ± 1.4</td>
<td>9.3 ± 1.4</td>
<td>9.5 ± 1.7</td>
</tr>
<tr>
<td>Mean A1c – 3 y</td>
<td>8.4 ± 2.2</td>
<td>6.7 ± 1.3</td>
<td>7.0 ± 1.3</td>
</tr>
<tr>
<td>Mean weight – baseline</td>
<td>104 ± 14</td>
<td>106 ± 15</td>
<td>101 ± 16</td>
</tr>
<tr>
<td>Mean weight – 3 y</td>
<td>100 ± 16</td>
<td>81 ± 15</td>
<td>79 ± 16</td>
</tr>
</tbody>
</table>
Bariatric Surgery versus Intensive Medical Therapy for Diabetes — 5-Year Outcomes


<table>
<thead>
<tr>
<th></th>
<th>IMT</th>
<th>RYGB</th>
<th>Sleeve</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1c ≤ 6 with meds 1 y</td>
<td>12%</td>
<td>42%</td>
<td>37%</td>
</tr>
<tr>
<td>A1c ≤ 6 with meds 3 y</td>
<td>5%</td>
<td>38%</td>
<td>24%</td>
</tr>
<tr>
<td>A1c ≤ 6 with meds 5 y</td>
<td>5%</td>
<td>29%</td>
<td>23%</td>
</tr>
<tr>
<td>A1c ≤ 6 without meds 1 y</td>
<td>0</td>
<td>42%</td>
<td>27%</td>
</tr>
<tr>
<td>A1c ≤ 6 without meds 3 y</td>
<td>0</td>
<td>35%</td>
<td>20%</td>
</tr>
<tr>
<td>A1c ≤ 6 without meds 5 y</td>
<td>0</td>
<td>22%</td>
<td>15%</td>
</tr>
</tbody>
</table>
Does bariatric surgery reduce the risk of major cardiovascular events?
A retrospective cohort study of morbidly obese surgical patients

John D. Scott, M.D., F.A.C.S., F.A.S.M.B.S.*, Brent L. Johnson, M.S.,
Dawn W. Blackhurst, Dr.P.H., Eric S. Bour, M.D., F.A.C.S., F.A.S.M.B.S.
Greenville Hospital System University Medical Center, University of South Carolina School of Medicine, Greenville, Greenville, South Carolina
Received May 1, 2011; accepted September 5, 2011

Retrospective cohort study from state of South Carolina
- 4,747 bariatric surgery
- 3,066 obese orthopedic surgery control
- 1,327 obese GI surgery control

Primary outcome measure → time to occurrence
- Myocardial infarction
- Stroke
- All-cause death
Does bariatric surgery reduce the risk of major cardiovascular events?
A retrospective cohort study of morbidly obese surgical patients

<table>
<thead>
<tr>
<th>Event-free Survival</th>
<th>1 year</th>
<th>3 year</th>
<th>5 year</th>
<th>HR BS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bariatric surgery</td>
<td>97.5%</td>
<td>92.7%</td>
<td>84.8%</td>
<td></td>
</tr>
<tr>
<td>Ortho surg control</td>
<td>96.1%</td>
<td>85.6%</td>
<td>72.8%</td>
<td>0.72 *</td>
</tr>
<tr>
<td>GI surg control</td>
<td>93.4%</td>
<td>79.9%</td>
<td>65.8%</td>
<td>0.48 *</td>
</tr>
</tbody>
</table>

**Does bariatric surgery reduce the risk of major cardiovascular events?**

*A retrospective cohort study of morbidly obese surgical patients*

### Myocardial Infarction

<table>
<thead>
<tr>
<th></th>
<th>Incidence</th>
<th>5-Yr Surv</th>
<th>HR BS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bariatric surgery</td>
<td>1.7%</td>
<td>92.4%</td>
<td></td>
</tr>
<tr>
<td>Ortho surg control</td>
<td>6.1%</td>
<td>85.6%</td>
<td>0.59 *</td>
</tr>
<tr>
<td>GI surg control</td>
<td>7.2%</td>
<td>83.9%</td>
<td>0.49 *</td>
</tr>
</tbody>
</table>

### Stroke

<table>
<thead>
<tr>
<th></th>
<th>Incidence</th>
<th>5-Yr Surv</th>
<th>HR BS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bariatric surgery</td>
<td>0.3%</td>
<td>98.1%</td>
<td></td>
</tr>
<tr>
<td>Ortho surg control</td>
<td>1.6%</td>
<td>96.1%</td>
<td>0.69</td>
</tr>
<tr>
<td>GI surg control</td>
<td>1.6%</td>
<td>96.1%</td>
<td>0.49 *</td>
</tr>
</tbody>
</table>

### All-Cause Death

<table>
<thead>
<tr>
<th></th>
<th>Incidence</th>
<th>5-Yr Surv</th>
<th>HR BS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bariatric surgery</td>
<td>1.7%</td>
<td>92.7%</td>
<td></td>
</tr>
<tr>
<td>Ortho surg control</td>
<td>7.0%</td>
<td>84.2%</td>
<td>0.81</td>
</tr>
<tr>
<td>GI surg control</td>
<td>10.8%</td>
<td>77.8%</td>
<td>0.45 *</td>
</tr>
</tbody>
</table>
Hypertension remission 1 year after bariatric surgery: predictive factors

Lilliam Flores, M.D., Ph.D. \textsuperscript{a,b,\*}, Josep Vidal, M.D., Ph.D. \textsuperscript{a,b,c}, Silvia Canivell, M.D. \textsuperscript{b,c}, Salvadora Delgado, M.D., Ph.D. \textsuperscript{d}, Antonio Lacy, M.D., Ph.D. \textsuperscript{d}, Enric Esmatjes, M.D., Ph.D. \textsuperscript{b,c,e}


- 526 obese patients undergoing bariatric surgery
  - 50\% with hypertension
  - 34\% with DMII
- Retrospective review
- Follow-up 1 year
- Primary outcome measure $\rightarrow$ HTN remission
  - BP $< 140/90$ off of all medications

Hypertension remission 1 year after bariatric surgery: predictive factors

Table 3
Multivariate logistic regression analysis investigating the association between predictive factors and the risk of being hypertensive

<table>
<thead>
<tr>
<th></th>
<th>Reference</th>
<th>Odds ratio</th>
<th>P value</th>
<th>95% CI for OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>≤40 years</td>
<td>5.73</td>
<td>.0001</td>
<td>3.82 - 8.58</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>2.81</td>
<td>.0001</td>
<td>1.74 - 4.55</td>
</tr>
<tr>
<td>WC (cm)</td>
<td>≤130</td>
<td>1.74</td>
<td>.009</td>
<td>1.15 - 2.64</td>
</tr>
</tbody>
</table>

WC = waist circumference; CI = confidence interval.
Hypertension remission 1 year after bariatric surgery: predictive factors

<table>
<thead>
<tr>
<th>Predictive Factor for Persistent HTN</th>
<th>OR</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time since diagnosis HTN &gt; 10 years</td>
<td>1.10</td>
<td>0.003</td>
</tr>
<tr>
<td>Number HTN drugs = 2</td>
<td>2.41</td>
<td>0.036</td>
</tr>
<tr>
<td>Number HTN drugs = 3</td>
<td>11.51</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

65% HTN remission

OU Metabolic & Bariatric Surgery Program
Harold Hamm Diabetes Center
1000 Lincoln Ave, Suite 3200 (across from endocrinology!)
Phone: 405.271.9448
Email: OUBariatricSurgery@ouhsc.edu
Bariatric Program

- Information Seminar
- Complete medical evaluation
  - History & physical
  - Nutrition assessment
  - Behavioral health assessment
  - Physical therapy evaluation
- Nutrition education classes x 2
- Optimization of co-morbidities
- Pre-op education class & surgical clearance
- Surgery
- Follow-up: 1 wk, 1m, 3m, 6m, 9m, 12m, 18m, 24m + annual
- Support Groups: monthly

Specialists involved:
- NP
- RD
- PT
Nutritional Counseling

- TWO education classes
- Mindful eating
- Plate method
- 64+ oz water
- 60+ g protein
- Avoid sugar / carbs
- Avoid alcohol
- Vitamin supplements
Common Tests

- Blood tests (e.g. Hgb A1c, calcium, vitamin D, TSH)
- EKG
- Chest X-ray
- Sleep study
- EGD
- Colonoscopy
- Mammogram
- Pap smear
- Cardiac stress test
### Supplements

**Multivitamin with 100% DRI**

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin K</td>
<td>90-120 mcg</td>
</tr>
<tr>
<td>Biotin</td>
<td>30 mcg</td>
</tr>
<tr>
<td>Thiamin</td>
<td>1.1-1.2 mcg</td>
</tr>
<tr>
<td>Folic Acid</td>
<td>400 mcg</td>
</tr>
<tr>
<td>Zinc</td>
<td>11 mcg</td>
</tr>
<tr>
<td>Copper</td>
<td>900 mcg</td>
</tr>
<tr>
<td>Iron</td>
<td>8-18 mcg</td>
</tr>
</tbody>
</table>

- **Calcium**: 1200-1500 mg
- **Vitamin D**: 3000 IU
- **Vitamin B12**: 2.4 mcg, increase PRN
- **Iron**: 45-60 mg (total + MV)
Life After Surgery

- Follow-up!
  - Weight check
  - Annual nutrition labs
  - Nutritional counseling

- Gradually advance diet

- Gradually increase exercise

- Daily vitamins

- PCP visits
  - Stop medications as health problems resolve!

Bariatric Program

- Nurse Practitioner: Judy Vorheis, FNP
- Dietitians: Dianne Brown, MS LD/RD, Christine Olson, MS LD/RD
- Psychologist: John Linck, PhD
- Physical Therapist: Renee Thomas, DPT
- Clinic Manager: Jessica Moates
- Medical Assistant: Nisha Gatewood
- Patient Service Rep: Cindy Trent
- Financial Counselor: Ashley Graham
- Surgeon: Laura Fischer, MD MS
Case Study – Patient JT

- **60 lbs** weight loss!  BMI 41.44 → **33.5**
- Hypertension (2006) – Carvedilol, Lisinopril
- DM II (2009) – A1c 5.7% on Metformin, Levemir, & Humalog
- Obstructive sleep apnea – compliant with CPAP
- CHF (2015) – Lasix, aspirin
  - LVEF 50-55%
  - LVH
  - Grade I diastolic dysfunction
- Renal insufficiency – Cr 1.5, GFR 47
- Osteoarthritis – walking better with less pain, daily ibuprofen
Success Story!

Images used with patient permission and signed consent.