Obesity and TKA: Optimization, Management and Outcomes

April 8, 2019
7:15 PM

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Disclosures

• Gregory Golladay, MD (Richmond, VA)
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Patient selection and optimization of obesity in TKA

Antonia F. Chen, MD/MBA
Director of Research, Arthroplasty Services

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Harvard Medical School
Disclosures

Antonia F Chen, MD, MBA Submitted on: 02/13/2019

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Obesity Epidemic

**Obesity Trends** Among U.S. Adults  
BRFSS, 1990, 2000, 2010  
(*BMI ≥30, or about 30 lbs. overweight for 5’4” person)  

1990

2000

2010

Source: CDC
# Definition of Obesity

## WHO Classification of Weight Status

<table>
<thead>
<tr>
<th>Weight Status</th>
<th>Body Mass Index (BMI), kg/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.5</td>
</tr>
<tr>
<td>Normal range</td>
<td>18.5 – 24.9</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0 – 29.9</td>
</tr>
<tr>
<td>Obese</td>
<td>≥ 30</td>
</tr>
<tr>
<td>Obese class I</td>
<td>30.0 – 34.9</td>
</tr>
<tr>
<td>Obese class II</td>
<td>35.0 – 39.9</td>
</tr>
<tr>
<td>Obese class III</td>
<td>≥ 40</td>
</tr>
</tbody>
</table>
Increase rise of TKA in Obese patients

Fig. 1
A line graph showing trends in mean BMI and percentage of obese patients (BMI of ≥30 kg/m²) who underwent total knee arthroplasty (TKA) from 2000 to 2008.

The Effect of Obesity on Direct Medical Costs in Total Knee Arthroplasty

Hilal Maradit Kremers, MD, MSc, Sue L. Visscher, PhD, Walter K. Kremers, PhD, James M. Naessens, ScD, and David G. Lewallen, MD


---

**Primary TKA**
- Mean
- Median
- Without comorbidities
- Without complications

**Revision TKA**
- Mean
- Median
- Without comorbidities
- Without complications

![Graph showing the effect of obesity on medical costs](graph.png)

---

**Index hospitalization costs ($)**

- Body mass index categories (kg/m²): <18.5, 18.5-<25, 25-<30, 30-<35, 35-<40, 40-<45, 45-<50, ≥50

**Total 90-day costs ($)**

- Body mass index categories (kg/m²): <18.5, 18.5-<25, 25-<30, 30-<35, 35-<40, 40-<45, 45-<50, ≥50
• **Morbid obesity alone had increased:** wound dehiscence, in-hospital infection, GU complications, extended stay facilities, and in-hospital death
Wound Healing

• Increased dead space, adipose tissue healing

Total Knee Arthroplasty in Morbidly Obese Patients*

BY RAZ WINIARSKY, M.D.†, PATRICK BARTH, C.R.C.†, AND PAUL LOTKE, M.D.†, PHILADELPHIA, PENNSYLVANIA

• BMI > 40kg/m² = 22% wound complication
• Normal BMI = 2% wound complication rate

Winiarsky et al. JBJS J Bone Joint Surg Am, 1998 Dec 01;80(12):1770-4
Increased pro-inflammatory cytokines

Tateya et al. *Front Endocrinol (Lausanne)*. 2013 Aug 8;4:93
Mice infected with *Porphyromonas gingivalis* (common oral bacteria)

Mice with diet-induced obesity had higher bacteria count and greater alveolar bone loss and

Obese patients have \(\uparrow\) IL-1\(\beta\), IL-6, and TNF-\(\alpha\) levels
• BMI > 30 kg/m² was present in 42.9% of malnourished patients
• Significantly higher complication rate

Huang et al. J Arthroplasty. 2013 Sep;28(8 Suppl):21-4
Malnutrition

- **Albumin** < 3.5 g/dL
- **Prealbumin** < 18 mg/dL
- **Total protein** < 6.0 g/dL
- **Total lymphocyte count** < 1,500 cells
- **Iron** < 45 μg/dL
- **Serum transferrin** < 200 mg/dL
- **25-OH Vitamin D** < 30ng/mL

Malnutrition

International Scholarly Research Network
ISRN Endocrinology
Volume 2012, Article ID 103472, 8 pages
doi:10.5402/2012/103472

Review Article
The Malnutrition of Obesity: Micronutrient Deficiencies That Promote Diabetes

Michael Via

TABLE 1: Prevalence of micronutrient deficiencies in obesity and diabetes [5, 6, 46, 58–61].

<table>
<thead>
<tr>
<th>Micronutrient</th>
<th>Prevalence of deficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obesity</td>
</tr>
<tr>
<td>Thiamine B1</td>
<td>15–29%</td>
</tr>
<tr>
<td>Pyridoxine B6</td>
<td>0–11%</td>
</tr>
<tr>
<td>Cobalamin B12</td>
<td>3–8%</td>
</tr>
<tr>
<td>Folic Acid</td>
<td>3–4%</td>
</tr>
<tr>
<td>Ascorbic acid C</td>
<td>35–45%</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>17%</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>80–90%&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>0%</td>
</tr>
<tr>
<td>Zinc</td>
<td>14–30%</td>
</tr>
<tr>
<td>Chromium</td>
<td>—</td>
</tr>
<tr>
<td>Selenium</td>
<td>58%</td>
</tr>
</tbody>
</table>
Patient Optimization and Selection

- Strict BMI criteria (< 35 to 40 kg/m²)
- Require Preoperative Weight Reduction
- Poss Nutrition consult
- Medical optimization

Body Fat measurement

- Body mass index calculation

WAIST HIP RATIO

Skin calipers

DEXA scan

Air-displacement plethysmography
## Weight Reduction

### Methods of Weight Loss

<table>
<thead>
<tr>
<th>Method</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut Down on Foods High in Sugar</td>
<td>86%</td>
</tr>
<tr>
<td>Eat Smaller Portions of Favorite Foods</td>
<td>85%</td>
</tr>
<tr>
<td>Use Low-Cal, Reduced-Sugar, Sugar-Free Foods and Beverages</td>
<td>78%</td>
</tr>
<tr>
<td>Combine Calorie Reduction with Exercise</td>
<td>73%</td>
</tr>
<tr>
<td>Exercise Moderately, 45 minutes / 3 times per week</td>
<td>64%</td>
</tr>
<tr>
<td>Count Calories</td>
<td>44%</td>
</tr>
<tr>
<td>Chew Gum</td>
<td>37%</td>
</tr>
<tr>
<td>Use Online Weight Loss Tools</td>
<td>17%</td>
</tr>
<tr>
<td>Skip Meals to Diet</td>
<td>17%</td>
</tr>
<tr>
<td>Use Diet Pills</td>
<td>13%</td>
</tr>
<tr>
<td>Follow a Restrictive Weight Loss Diet (such as Atkins or The Zone)</td>
<td>8%</td>
</tr>
<tr>
<td>Join Weight Control Programs</td>
<td>8%</td>
</tr>
<tr>
<td>Participate in Online Weight Loss Programs</td>
<td>7%</td>
</tr>
</tbody>
</table>

*Source: Calorie Control Council National Consumer Survey, 2010*
Intervention

Bariatric Surgery Prior to Total Joint Arthroplasty May Not Provide Dramatic Improvements in Post-Arthroplasty Surgical Outcomes

Maria C.S. Inacio, PhD, Elizabeth W. Paxton, MA, David Fisher, MD, Robert A. Li, MD, Thomas C. Barber, MD, Jasvinder A. Singh, MD, MPH

Revision surgery or 90-day readmission
Review

Does Prior Bariatric Surgery Improve Outcomes Following Total Joint Arthroplasty in the Morbidly Obese? A Meta-Analysis

Shuxiang Li, MD, Xiaomin Luo, MD, Han Sun, MD, Kun Wang, MD, PhD, Kaifeng Zhang, MD, Xiaoliang Sun, MD, PhD*

Table 2
Subgroup Meta-Analysis by Sample Size.

<table>
<thead>
<tr>
<th>Outcomes and Demographics</th>
<th>P-Value of Combined Small Sample Size Studies</th>
<th>P-Value of Combined Large Sample Size Studies</th>
<th>P-Value of Combined all Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term medical complications</td>
<td>.03</td>
<td>&lt;.00001</td>
<td>&lt;.00001</td>
</tr>
<tr>
<td>Short-term periprosthetic infection</td>
<td>.06</td>
<td>.24</td>
<td>.09</td>
</tr>
<tr>
<td>Short-term VTE (DVT and/or PE)</td>
<td>.80</td>
<td>.11</td>
<td>.12</td>
</tr>
<tr>
<td>Long-term dislocation</td>
<td>.52</td>
<td>.22</td>
<td>.51</td>
</tr>
<tr>
<td>Long-term periprosthetic infection</td>
<td>.56</td>
<td>.63</td>
<td>.54</td>
</tr>
<tr>
<td>Long-term revision</td>
<td>.46</td>
<td>.34</td>
<td>.93</td>
</tr>
<tr>
<td>Long-term periprosthetic fracture</td>
<td>.73</td>
<td>.77</td>
<td>.72</td>
</tr>
</tbody>
</table>

Bold values indicate a statistically significant P-value.

VTE, venous thromboembolism; DVT, deep vein thrombosis; PE, pulmonary embolism.

TKA reduced short-term PJ (not THA)
Primary Arthroplasty

Does Prior Bariatric Surgery Affect Implant Survivorship and Complications Following Primary Total Hip Arthroplasty/Total Knee Arthroplasty?

Gwo-Chin Lee, MD a,*, Kevin Ong, PhD b, Doruk Baykal, PhD b, Edmund Lau, MS b, Arthur L. Malkani, MD c

- Medicare 5% part B data (1999 to 2012)
- Primary TKA = 86,609, Primary THA = 47,895
- Patients with prior bariatric surgery before arthroplasty were compared to patients with other common metabolic conditions
### Table 4
Primary TKA Patients With the Metabolic Bone Condition (Percent and Sample Size), as well as the Adjusted Risk of Revision (Any Reason).

<table>
<thead>
<tr>
<th>Condition</th>
<th>TKA With Condition (%)</th>
<th>TKA With Condition (n)</th>
<th>0.5 y Revision Risk</th>
<th>1 y Revision Risk</th>
<th>2 y Revision Risk</th>
<th>5 y Revision Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>AHR</td>
<td>P-Value</td>
<td>AHR</td>
<td>P-Value</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>24.7</td>
<td>21,418</td>
<td>1.26</td>
<td>.016</td>
<td>1.26</td>
<td>.001</td>
</tr>
<tr>
<td>Impaired renal function</td>
<td>11.8</td>
<td>10,196</td>
<td>1.15</td>
<td>.259</td>
<td>1.11</td>
<td>.293</td>
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<tr>
<td>Diabetes</td>
<td>29</td>
<td>25,130</td>
<td>1.16</td>
<td>.129</td>
<td>1.12</td>
<td>.136</td>
</tr>
<tr>
<td>Vitamin D deficiency</td>
<td>5.6</td>
<td>4861</td>
<td>0.89</td>
<td>.56</td>
<td>0.79</td>
<td>.161</td>
</tr>
<tr>
<td>Hyperparathyroidism</td>
<td>1.3</td>
<td>1083</td>
<td>0.39</td>
<td>.074</td>
<td>0.63</td>
<td>.189</td>
</tr>
<tr>
<td>Hypoparathyroidism</td>
<td>0.2</td>
<td>132</td>
<td>3.49</td>
<td>.026</td>
<td>2.03</td>
<td>.215</td>
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<tr>
<td>Calcium metabolism disorder</td>
<td>3.3</td>
<td>2854</td>
<td>1.23</td>
<td>.514</td>
<td>1.21</td>
<td>.437</td>
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<tr>
<td>Hypocalcemia</td>
<td>0.5</td>
<td>418</td>
<td>0.74</td>
<td>.627</td>
<td>0.64</td>
<td>.413</td>
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<tr>
<td>Hypercalcemia</td>
<td>1.3</td>
<td>1134</td>
<td>0.68</td>
<td>.452</td>
<td>0.46</td>
<td>.085</td>
</tr>
<tr>
<td>Arthopathy</td>
<td>&lt;0.1</td>
<td>30</td>
<td>0</td>
<td>&lt;.001</td>
<td>0</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Paget’s disease</td>
<td>0.2</td>
<td>169</td>
<td>1.7</td>
<td>.442</td>
<td>0.98</td>
<td>.98</td>
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<tr>
<td>Osteomalacia</td>
<td>0.4</td>
<td>322</td>
<td>1.21</td>
<td>.758</td>
<td>1.84</td>
<td>.125</td>
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<tr>
<td>Osteoedystrophy</td>
<td>0.1</td>
<td>104</td>
<td>0</td>
<td>&lt;.001</td>
<td>0</td>
<td>&lt;.001</td>
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<tr>
<td>Cushing’s syndrome</td>
<td>0.1</td>
<td>80</td>
<td>0</td>
<td>&lt;.001</td>
<td>0.85</td>
<td>.873</td>
</tr>
<tr>
<td>HIV</td>
<td>0.1</td>
<td>98</td>
<td>2.39</td>
<td>.217</td>
<td>2.21</td>
<td>.163</td>
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<tr>
<td><strong>Bariatric surgery</strong></td>
<td><strong>0.1</strong></td>
<td><strong>70</strong></td>
<td><strong>1.75</strong></td>
<td><strong>.58</strong></td>
<td><strong>4.3</strong></td>
<td><strong>.003</strong></td>
</tr>
</tbody>
</table>

AHR, adjusted hazard ratio; HIV, human immunodeficiency virus.

### Table 5
Primary TKA Patients With the Metabolic Bone Condition (Percent and Sample Size), as well as the Adjusted Risk of Revision for Periprosthetic Joint Infection.

<table>
<thead>
<tr>
<th>Condition</th>
<th>TKA With Condition (%)</th>
<th>TKA With Condition (n)</th>
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<td>1.41</td>
<td>.041</td>
<td>1.33</td>
<td>.046</td>
</tr>
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</tr>
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<td>Hyperparathyroidism</td>
<td>1.3</td>
<td>1083</td>
<td>0</td>
<td>&lt;.001</td>
<td>0.23</td>
<td>.159</td>
</tr>
<tr>
<td>Hypoparathyroidism</td>
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<td>.086</td>
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<td>.2</td>
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<td>.074</td>
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<td>0.5</td>
<td>418</td>
<td>0.52</td>
<td>.494</td>
<td>0.38</td>
<td>.322</td>
</tr>
<tr>
<td>Hypercalcemia</td>
<td>1.3</td>
<td>1134</td>
<td>0.55</td>
<td>.47</td>
<td>0.35</td>
<td>.188</td>
</tr>
<tr>
<td>Arthopathy</td>
<td>&lt;0.1</td>
<td>30</td>
<td>0</td>
<td>&lt;.001</td>
<td>0</td>
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<td>HIV</td>
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<td>&lt;.001</td>
<td><strong>0</strong></td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

AHR, adjusted hazard ratio; HIV, human immunodeficiency virus.
Nutritional Supplementation

- 14 days prior to surgery - nutritional supplementation twice a day
Vitamin D

• **Vitamin D Level 10-30ng/mL**
  – Vitamin D2 50,000 IU PO x 4 weeks
  – Vitamin D2 800 IU daily

• **Vitamin D Level <10ng/mL**
  – Endocrine consult
  – Vitamin D2 50,000 IU PO x 3 days
  – Three times/wk for 3 extra weeks (12 doses)
Medical Optimization

- Cardiac disease
- Renal disease
- Peripheral vascular disease
- Pulmonary circulation disorders
- Diabetes
  - Strict HgbA1C criteria
  - Tightly controlled glucose

Harris et al. *J Arthroplasty*. 2013 Sep;28(8 Suppl):25-9
Diabetes

- Surgical stress antagonizes insulin
  - Predisposes patients to hyperglycemia
  - Impairs ability of leukocytes to stop infection
  - Hyperglycemia predisposes diabetic and nondiabetic patients to infection

Richards JBJS 2012, Stryker JBJS 2013
Diabetes

**Hemoglobin A1C**

7.7%

**GOAL**: Maintain Glucose < 200

**Optimal blood glucose threshold of 137 mg/dL**
Conclusions

- Obese patients have increased morbidity and mortality after TKA
- Preoperative intervention: weight loss, nutritional management, medical optimization
Thank You
Preoperative Planning and Technical Tips for TKA in the Obese Patient

Peter K. Sculco, MD
Assistant Attending, Adult Reconstruction
Hospital for Special Surgery
Disclosures

• Consultant
  – Lima Corporate
  – EOS Imaging

• Research Support
  – Intellijoint Surgical
Overview

• Background
• OR Set up + exposure
• Surgical tips
• Implant fixation
• Minimize wound complications
Body Mass Index

<table>
<thead>
<tr>
<th>BMI</th>
<th>Weight Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;18.5</td>
<td>Underweight</td>
</tr>
<tr>
<td>18.5 - 24.99</td>
<td>Normal</td>
</tr>
<tr>
<td>25 - 29.99</td>
<td>Overweight</td>
</tr>
<tr>
<td>30 - 34.99</td>
<td>Obese class I</td>
</tr>
<tr>
<td>35 - 39.99</td>
<td>Obese class II</td>
</tr>
<tr>
<td>≥ 40</td>
<td>Obese class III</td>
</tr>
</tbody>
</table>
Adult Obesity Prevalence

Percent of obese adults (Body Mass Index of 30+)

- 0 - 9.9%
- 10 - 14.9%
- 15 - 19.9%
- 20 - 24.9%
- 25 - 29.9%
- 30 - 34.9%
- 35%+

Map showing the prevalence of adult obesity across the United States, color-coded according to the percentage of obese adults.
Challenges of TKA in Obese Patients

- Increased technical difficulty
- Increased operative time
- Increased infection risk (superficial and deep)
- Increased revision/aseptic loosening rate
Functional Gain and Pain Relief After Total Joint Replacement According to Obesity Status

Methods
6 months post TKA and THA data
2,964 TKAs
Pre and Post SF36
BMI > 35 vs BMI < 35

Conclusion: Not surprisingly, the patients with higher BMI reported having substantial functional gain that was similar to the findings in other patients. While obesity is associated with a greater risk of early complications, obesity in itself should not be a deterrent to undergoing TJR to relieve symptoms.

Level of Evidence: Therapeutic Level II. See Instructions for Authors for a complete description of levels of evidence.
BMI 40
Periop: OR Time Allocation

![BMI Group vs. Operating Room Time Graph](image_url)
Peri-op: Weight based Antibiotic Prophylaxis

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Tradename</th>
<th>Dose</th>
<th>Timing</th>
<th>Postop Dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefazolin</td>
<td>Ancef</td>
<td>1 g, if &lt;170 lbs</td>
<td>30 min prior</td>
<td>Q8H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 g, if 170 - 260</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 g, if &gt;260 lbs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>Ceftin</td>
<td>1.5 g</td>
<td>30 min prior</td>
<td>Q12H</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>Cleocin</td>
<td>900 mg</td>
<td>30 min prior</td>
<td>Q6H</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>Vancocin</td>
<td>15 mg/kg</td>
<td>60 min prior</td>
<td>Q12H</td>
</tr>
</tbody>
</table>
Set up and Exposure

- Leg holders, lateral post, supportive operative tables
- Careful tourniquet application (consider sterile tourniquet)
- Longer incision
- Avoid tension on distal skin
- Minimize lateral flap (limit seroma/deadspace)
- Medial parapatellar, subvastus, midvastus approach
- Consideration for leaving patella unresurfaced
- If patella cut early use metallic patella protector
- Additional retractor
Surgical Tips

• Be careful of MCL and Patella tendon avulsion injury
• Avoid excessive external rotation and hyperflexion
• Remove osteophytes early (decompress)
• Consideration for completing all femoral bone cuts FIRST
  (easier to expose the tibia)
• Flexion gap assessed while pulling up on thigh
• Careful assessment of terminal extension (look at components)

Liu et al. J Knee Surg 2013
Achieving Accurate Coronal Alignment in Obese TKA

Risk factors for Varus Tibial Resection

- Preoperative Varus
- Increased BMI

Tibial Resection Options

- Extramedullary
- Intramedullary (maybe faster than EM)
- Intraoperative x-ray
- Possible benefit to use of computer navigation
  - (93% within +/- 3 deg with CAS vs 56% mechanical BMI > 35)

Lustig et al. Knee Society 2016
Lozano, Obesity Surgery, 2008
Choong et al. JOA 2009
Implant Fixation

Increased reported rates of:
- Osteolysis
- Radiolucency
- Poly wear
- Malalignment
- Component loosening
- Catastrophic tibia varus collapse with elevated BMI

Fehring et al, JOA 2017
Catastrophic Varus Collapse of the Tibia in Obese Total Knee Arthroplasty

Thomas K. Fehring, MD, Keith A. Fehring, MD, Lucas A. Anderson, MD, Jesse E. Otero, MD, Bryan D. Springer, MD

- Small implant + High BMI = Fatigue failure of proximal tibia
- Most tibial failures had bone stress > 300,000 Pascals
- Recommend 30mm stem extension to decrease stress
Magnitude of Cement-Device Interfacial Stresses with and without Tibial Stemming: Impact of BMI

Gopalakrishnan, J Knee Surgery, 2011
Increased Aseptic Tibial Failures in Patients With a BMI $\geq$ 35 and Well-Aligned Total Knee Arthroplasties

Matthew P. Abdel, MD, George F. Bonadurer III, BS, Matthew T. Jennings, BS, Arlen D. Hanssen,

**Methods**

- Retrospective review of 5,088 TKAs
- Incidence of tibial component aseptic loosening BMI $> 35$ vs $< 35$

**Results**

At 15 years, BMI $> 35$

- Tibial revision for aseptic loosening **2x higher**
- **ALL** tibial failures in implants **WITHOUT** stem extensions

Abdel et al.
BJJ 2015
Methods

Cemented vs Cementless TKA (PS)
Same design
BMI > 40
min f/u 5 years
108 cementless
85 cemented
(unknown if stems used)

Results

Cemented: 16 loosening (18.8%)
Cementless: 1 loosening (0.9%)

Conclusion: Morbidly obese patients (BMI ≥ 40) have a higher failure due to aseptic loosening with cemented TKA with decreasing survivorship over time. The use of cementless TKA in morbidly obese patients with the potential of durable long-term biologic fixation and increased survivorship appears to be a promising alternative to mechanical cement fixation.
Case Example: Cementless TKA in Morbidly Obese

67 y/o female

8 year f/u
staged bilateral TKA
Well fixed
Infection Reduction Measures

- Antibiotic cement
- Dilute betadine or other anti-septic solution
- Water-tight multi-layered closure
  - Arthrotomy: interrupted combined with a running suture
  - Skin: running monocryl but staples or nylon if skin tenuous
  - Skin sealant
- Occlusive dressing
- Closed incision negative pressure wound therapy
Complications - Infection

Subcutaneous Fat Thickness Is Associated With Early Reoperation and Infection After Total Knee Arthroplasty in Morbidly Obese Patients

Chad D. Watts, MD, Matthew T. Houdek, MD, Eric R. Wagner, MD, Michael J. Taunton, MD

Department of Orthopedic Surgery, Mayo Clinic, Rochester, Minnesota

Risk Analysis.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Risk Ratio</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepatellar thickness $\geq 15$ mm</td>
<td>2.0</td>
<td>.0003</td>
</tr>
<tr>
<td>Pretubercular thickness $\geq 25$ mm</td>
<td>1.6</td>
<td>.023</td>
</tr>
<tr>
<td>BMI $\geq 50$ kg/m$^2$ (relative to BMI 40-50 kg/m$^2$)</td>
<td>1.0</td>
<td>.79</td>
</tr>
</tbody>
</table>

Conclusion: Anterior knee subcutaneous fat thickness can be reproducibly measured on lateral knee radiographs and is associated with a significantly increased risk of early reoperation for wound complications and infection after primary TKA in morbidly obese patients.
The Use of Closed Incision Negative-Pressure Wound Therapy in Orthopaedic Surgery

Strong evidence exists to support the use of ciNPWT in high risk primary TKA

Reduced:
- wound drainage
- Seroma/hematoma formation
- Edema
- Enhanced wound healing
- Cost

Nam et al. JAAOS, 2015
Summary

- Allocate appropriate operative resources
- Reduce peri-op infection risk with weight based antibiotics, anti-septic irrigation, water-tight closure, and ciNPWT
- Avoid excessive traction of MCL/patella, distal skin with long incision, long arthrotomy, femur first resection
- Tibia Stem extensions in BMI > 35
  (either 30-50mm cemented stem or uncemented long-stem)
- Growing evidence supporting use of uncemented tibial component fixation in BMI > 35
Thank you
Complications of TKA in Obese Patients and Their Management

Brett Levine, MD, MS
Associate Professor
Rush University Medical Center
Service Line Director
Elmhurst Memorial Hospital Center
Disclosures

• Paid Consultant
  – Link
  – Merete
  – McGraw-Hill
  – Medacta
  – DJO
  – Exactech

• Research Funding
  – Zimmer-Biomet
  – Artelon

• Royalties
  – Human Kinetics
  – Slack Inc

• Committees
  – AAOS Arthroplasty Evaluation Committee
  – AAHKS Research and Patient Education Com.
Topics

• What are common complications associated with obese patients and TKA
  • Intraoperative Complications
  • Postoperative Complications
    • In-hospital
    • Post-hospital
Obesity

• Major health concern in USA
  – 20-52% of TKA cases are in obese patients

• Associated with increased risk for
  – DM
  – Heart disease
  – HTN
  – Poor nutrition
  – Early mortality

– As well as the need for TKA!
Intraoperative Complications

- **Difficult exposure**
  - Local tissue injury
  - Prolonged surgery
  - Wound healing concerns
  - Excessive traction on retractors

- **Component alignment**
  - Hard to find landmarks

- Fighting local tissues for exposure
- Body habitus pushes tibia forward with flexion

- **Patella concerns**
  - Fracture
  - Tendon injuries
Difficult Exposures

• Solutions:
  – Use larger incision
  – Consider medial parapatellar approach (easily extended)
  – Respect the local soft tissues
  – Full thickness flaps
  – Low threshold for Quad Snip if needed or conversion to extensile exposure
Component Alignment

• Solutions:
  – Component Alignment
    • Consider IM guides
    • Computer navigation
    • Custom cutting guides
    • Intraoperative fluoroscopy and placement of markers
Patella Concerns

• Solutions:
  – Avoid over-resection
  – Do not grab patella with towel clips
  – Avoid excessive retraction on EM
  – Leave patella unresurfaced
Postoperative Complications

- Patellofemoral issues
  - Pain
  - Fracture
  - Loosening
  - Tendon ruptures
- Wound healing problems
- PJI

Medical Complications
- Readmission Concerns

Schwarzkopf et al (2012)—Reported that a BMI >45 is associated with an 8.44 times increase in the odds of developing an in-hospital complication
In-Hospital Complications

  - NIS Database
  - 98,410 (5.5%) of database TKAs were morbidly obese
  - Higher risk for:
    - In-hospital infection—0.24% v. 0.17%
    - Wound dehiscence—0.11% v. 0.08%
    - GU complications—0.60% v. 0.44%
    - In-hospital mortality—0.08% v. 0.02%
    - Increased LOS—3.6 v. 3.5 days
    - Cost—$15,174 v. $14,715
    - DC to SNF—40% v. 30%

- No differences in:
  - VTE
  - CV Events
  - Respiratory complications
  - GI
  - CNS
  - Hematoma/seroma
  - Peripheral vascular

- Obesity is an independent risk factor inpatient postop complications
What to do?

- Prevention is best medicine
  - Preop weight loss
  - Nutrition optimization
  - Diabetes control
  - Home preparation
  - Possible Preop PT
  - Incentive spirometry and respiratory care

- Other Options:
  - Avoid catherization
  - Avoid over-narcotizing
  - Early mobilization
  - Medical Co-management
Patellofemoral Issues

- Difficult Problem
- Leg Size
  - May push tibia anteriorly increasing PF compartment forces
- Tendon Ruptures
  - May start during surgery
  - Weight can affect forces across the EM tendons

- Solutions:
  - Not many useful ones once a fracture or tendon rupture
Post-Hospital Complications

- Wound Healing
- Infection
- Medical Complications
- Readmissions
Wound Healing Problems

• Larger "dead space" area

• Winiarsky et al (1998)
  – 22% wound complications in obese v. 2%

• Solutions:
  – Decrease dead space—change closure, add superficial drain
  – Negative-pressure wound vacuum therapy?
Namba (2005)—Highly obese TKA patients with 1.1% infection rate compared to 0.3% in non-obese
- 52% of TKA cohort were obese
- Odds ratio was 6.7 % times higher for highly obese group
- Possible factors—difficult exposure, longer operative times, poor vascularity and a weakened immune system.
Several studies have shown increased rate of PJI with increasing BMI

Watts et al (2014)
- Two-stage revision in these patients had a higher rate of failure
  - 32% v. 11% re-revision
  - 22% v. 4% re-infection
  - 51% v. 16% re-operation

Personal Experience
- Greater wound complications
  - Need for Flaps or Plastics Closure
  - Persistent Drainage
- Extensor mechanism complications
- Medical complications
- DC to SNF
- Late complications
PJI

• Management:
  – Prevention, prevention, prevention
  – Meticulous sterile technique
  • Possibly partial drape and re-prep
  – Weight based antibiotics
  – Pre-op screening and hibiclens baths/showers
Readmissions Concerns

• Lehtonen et al (2018)—NSQIP Study
  – 137,209 patients
  – Higher BMI categories were associated with significantly increased risk of readmission
  – Morbidly obese with greater readmission rate—4.24%
Readmissions Concerns

- Readmitted patients had a 58% vs. 10.4% complication rate
- 32.4% medical complications and 25.6% surgical complications

- Namba 2005—found 10 v. 8% percent readmission rate with highly obese
  - Higher rates of Diabetes with highly obese
    21 v. 12%
Readmissions

• Prevention:
  – Provide access to the office
  – Pre-emptive phone calls
  – Preoperative Education
  – Endorse a family or friend member as coach
Thank You For Your Attention
Trends and Outcomes of TJA in the Obese Patient

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Stanford University Medical Center

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Disclosure

James Irvin Huddleston III, MD (Redwood City, CA)
Submitted on: 10/06/2018
AAOS: Board or committee member
American Association of Hip and Knee Surgeons: Board or committee member
American Knee Society: Research support
Biomet: Paid consultant; Research support
California Joint Replacement Registry: Board or committee member; Paid consultant
Corin U.S.A.: Paid consultant; Paid presenter or speaker; Research support
Exactech, Inc: IP royalties; Paid consultant; Paid presenter or speaker
Hip Society: Board or committee member
Journal of Arthroplasty: Editorial or governing board
Knee Society: Board or committee member
Porosteon: Paid consultant; Stock or stock Options
Robert Wood Johnson Foundation: Research support
Wolters Kluwer Health - Lippincott Williams & Wilkins: Publishing royalties, financial or material support
Zimmer: Paid consultant; Paid presenter or speaker
Your Weight is about to Rise!

Helander, Wansink and Chieh, "Weight Gain over the Holidays in Three Countries."
What is Body Mass Index

- Normal
- Overweight
- Obese I (moderate)
- Obese II (severe)
- Obese III (morbid)
An Epidemic

# Let’s Talk Absolute Numbers

<table>
<thead>
<tr>
<th>State</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>38,332,521</td>
</tr>
<tr>
<td>Texas</td>
<td>26,448,193</td>
</tr>
<tr>
<td>New York</td>
<td>19,651,127</td>
</tr>
<tr>
<td>Florida</td>
<td>19,552,860</td>
</tr>
<tr>
<td>Illinois</td>
<td>12,882,135</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>12,773,801</td>
</tr>
<tr>
<td>Ohio</td>
<td>11,570,808</td>
</tr>
</tbody>
</table>
### Number of Patients with Obesity in the US

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese, All</td>
<td>81,820,525</td>
</tr>
<tr>
<td>Obese, Adults</td>
<td>68,562,082</td>
</tr>
<tr>
<td>California</td>
<td>38,332,521</td>
</tr>
<tr>
<td>Texas</td>
<td>26,448,193</td>
</tr>
<tr>
<td>New York</td>
<td>19,651,127</td>
</tr>
<tr>
<td>Florida</td>
<td>19,552,860</td>
</tr>
<tr>
<td>Obese, Children</td>
<td>13,258,443</td>
</tr>
<tr>
<td>Illinois</td>
<td>12,882,135</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>12,773,801</td>
</tr>
<tr>
<td>Ohio</td>
<td>11,570,808</td>
</tr>
</tbody>
</table>
Causes of the Obesity Epidemic

Affluent Sedentary Society

Poor Childhood Habits

Addictive Brain Chemistry

Portion Size
Lipotoxicity = Metabolic Syndrome

- Inflammation
- Arthritis
- Asthma
- Cancer
- Stroke
- Heart Attack
- PVD
- Hypertension
- Type 2 Diabetes
- Dyslipidemia
- Thrombosis

Slide courtesy of Dr. Robert Kushner, Northwestern University
Obesity is Social

Christakis+ NEJM 2007
What is THE NEW (AB)NORMAL?

Think things never change?
Except Airplane Seats
Obesity is Expensive

Jacobson, Center for Science and the Public Interest
Weight is a Global Epidemic

Ng+ Lancet 2014
Obesity is NOT the ONLY Epidemic
Demand Total Joint Replacement

3M Primary TKA by 2030
500K Primary THA by 2030

300K Revision TKA by 2030
50K Revision THA by 2030

Kurtz+ JBJS 2014
The Cost of Arthritis

• $128 billion/year
• $81 + $47 billion/year care + lost earnings
• #1 Cause of Disability

Yelin+ 2003
Prevalence of Arthritis in Patients with Obesity

Losina+ AC+R 2013
TKA in Patients with Obesity is Rising
Complications with TJA in Obese Patients

- Wound Healing – Superficial Infection
- Deep Infection
- Dislocation (i.e., Component Positioning)
- Aseptic Loosening
- Revision Surgery
- Ligament Rupture
- Deep Venous Thrombosis/Pulmonary Embolism
- Medical Complications (e.g., UTI, MI, etc.)

Gino+ JBJS 2012
D’Apuzzo+ CORR 2015
Pulos+ JOA 2014

Watts+ CORR 2015
Haverkamp+ Acta Orthop 2011
Even More Complications in the Morbidly Obese

**TKA @ 1 year**

<table>
<thead>
<tr>
<th></th>
<th>Obese</th>
<th>Morbidly obese</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound complications</td>
<td>18 (6.7)</td>
<td>9 (15.7)</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>38 (14.2)</td>
<td>15 (26.3)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Total surgical complications</td>
<td>22 (8.2)</td>
<td>5 (9.8)</td>
<td>0.973</td>
</tr>
<tr>
<td>Unplanned readmissions</td>
<td>29 (10.6)</td>
<td>13 (22.8)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Total adverse events</td>
<td>59 (22.1)</td>
<td>20 (35.1)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

**THA @ 4 years**

<table>
<thead>
<tr>
<th></th>
<th>Obese</th>
<th>Morbidly obese</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aseptic implant survivorship† (%)</td>
<td>97.5</td>
<td>94.1</td>
<td>0.15</td>
</tr>
<tr>
<td>Septic revision rate (%)</td>
<td>0</td>
<td>4.5</td>
<td>0.06</td>
</tr>
<tr>
<td>Overall implant survivorship (%)</td>
<td>97.8</td>
<td>89.6</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Dowsey+ JBJS 2010
Issa+ JBJS 2016
Cost with THA in Obese Patients

Every 5 kg/m² = $850 Primary and $1,350 Revision @ 90-day

Kremers+ CORR 2014
Does Obesity Affect the Time to Revision THA?

- Analyzed patients referred for revision THA to assess time from primary to revision THA and reason for THA

- Excluded if they did not have a date of primary surgery, preoperative BMI, or a minimum of one year of follow-up

- After exclusion, 257 revision THAs (245 patients) over 10 years from 2011-2013

- Age, gender, reason for revision THA, pre-operative BMI, and time from primary to revision THA in years were identified.

- Fisher exact test and a p-value of 0.005 after Bonferroni correction for multiple comparisons.
Increasing BMI Adversely Affects THA Survival
Reason for Revision THA = Early Loosening

<table>
<thead>
<tr>
<th>Reason for Revision</th>
<th>Non-obese</th>
<th>Obese</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early (before 5 years):</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aseptic Loosening/Osteolysis</td>
<td>54/281</td>
<td>37/112</td>
<td>0.005</td>
</tr>
<tr>
<td>Infection</td>
<td>45/64</td>
<td>28/45</td>
<td>0.422</td>
</tr>
<tr>
<td>Instability</td>
<td>36/72</td>
<td>20/26</td>
<td>0.021</td>
</tr>
<tr>
<td>Metallosis</td>
<td>13/19</td>
<td>7/7</td>
<td>0.146</td>
</tr>
<tr>
<td>Periprosthetic fracture</td>
<td>18/36</td>
<td>4/7</td>
<td>1.000</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>19/35</td>
<td>15/23</td>
<td>0.438</td>
</tr>
<tr>
<td><strong>Mid-term (between 5 and 10 years):</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aseptic Loosening/Osteolysis</td>
<td>44/281</td>
<td>24/112</td>
<td>0.411</td>
</tr>
<tr>
<td>Infection</td>
<td>14/64</td>
<td>11/45</td>
<td>0.185</td>
</tr>
<tr>
<td>Instability</td>
<td>20/72</td>
<td>3/26</td>
<td>0.112</td>
</tr>
<tr>
<td>Metallosis</td>
<td>4/19</td>
<td>0/7</td>
<td>0.546</td>
</tr>
<tr>
<td>Periprosthetic fracture</td>
<td>4/36</td>
<td>2/7</td>
<td>0.248</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>6/35</td>
<td>6/23</td>
<td>0.601</td>
</tr>
<tr>
<td><strong>Late (after 10 years):</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aseptic Loosening/Osteolysis</td>
<td>183/281</td>
<td>51/112</td>
<td>0.0004</td>
</tr>
<tr>
<td>Infection</td>
<td>5/64</td>
<td>6/45</td>
<td>0.356</td>
</tr>
<tr>
<td>Instability</td>
<td>16/72</td>
<td>3/26</td>
<td>0.385</td>
</tr>
<tr>
<td>Metallosis</td>
<td>2/19</td>
<td>4/7</td>
<td>0.028</td>
</tr>
<tr>
<td>Periprosthetic fracture</td>
<td>14/36</td>
<td>1/7</td>
<td>0.391</td>
</tr>
</tbody>
</table>
Obesity and Early THR for Loosening

[Graph showing the time to revision for obesity and non-obesity patients.]
Does Obesity Affect the Time to Revision TKA?

- Analyzed patients referred for revision TKA to assess time from primary to revision THA and reason for TKA
- Excluded if they did not have a date of primary surgery, preoperative BMI, or a minimum of one year of follow-up
- After exclusion, 666 revision TKAs (650 patients) over 10 years from 2011-2013
- Age, gender, reason for revision TKA, pre-operative BMI, and time from primary to revision TKA in years were identified.
- Fisher exact test and a p-value of 0.005 after Bonferroni correction for multiple comparisons.
Implant Failure NOT Confined to the Obese

![Graph showing time to revision vs percent revised for BMI ≤ 25 and BMI > 25. The graph demonstrates that implant failure is not confined to the obese.](Image)
<table>
<thead>
<tr>
<th>Time of Revision</th>
<th>Reason for Revision</th>
<th>Normal BMI</th>
<th>Elevated BMI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute (&lt;1 year)</td>
<td>Aseptic loosening/osteolysis</td>
<td>0/20 (0%)</td>
<td>4/130 (3%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Acute (&lt;1 year)</td>
<td>Infection</td>
<td>10/33 (30%)</td>
<td>31/138 (22%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Acute (&lt;1 year)</td>
<td>Instability</td>
<td>1/16 (6%)</td>
<td>20/133 (15%)</td>
<td>0.472</td>
</tr>
<tr>
<td>Acute (&lt;1 year)</td>
<td>Stiffness</td>
<td>1/10 (10%)</td>
<td>17/76 (22%)</td>
<td>0.681</td>
</tr>
<tr>
<td>Acute (&lt;1 year)</td>
<td>Miscellaneous</td>
<td>2/12 (17%)</td>
<td>17/98 (17%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Early (1-5 years)</td>
<td>Aseptic loosening/osteolysis</td>
<td>8/20 (40%)</td>
<td>55/130 (42%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Early (1-5 years)</td>
<td>Infection</td>
<td>8/33 (24%)</td>
<td>74/138 (54%)</td>
<td>0.003*</td>
</tr>
<tr>
<td>Early (1-5 years)</td>
<td>Instability</td>
<td>7/16 (44%)</td>
<td>76/133 (57%)</td>
<td>0.425</td>
</tr>
<tr>
<td>Early (1-5 years)</td>
<td>Stiffness</td>
<td>6/10 (60%)</td>
<td>41/76 (54%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Early (1-5 years)</td>
<td>Miscellaneous</td>
<td>6/12 (50%)</td>
<td>54/98 (55%)</td>
<td>0.767</td>
</tr>
<tr>
<td>Mid (5-10 years)</td>
<td>Aseptic loosening/osteolysis</td>
<td>7/20 (35%)</td>
<td>33/130 (25%)</td>
<td>0.417</td>
</tr>
<tr>
<td>Mid (5-10 years)</td>
<td>Infection</td>
<td>5/33 (15%)</td>
<td>21/138 (15%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Mid (5-10 years)</td>
<td>Instability</td>
<td>4/16 (25%)</td>
<td>25/133 (19%)</td>
<td>0.517</td>
</tr>
<tr>
<td>Mid (5-10 years)</td>
<td>Stiffness</td>
<td>2/10 (20%)</td>
<td>12/76 (16%)</td>
<td>0.664</td>
</tr>
<tr>
<td>Mid (5-10 years)</td>
<td>Miscellaneous</td>
<td>1/12 (8%)</td>
<td>13/98 (13%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Late (&gt;10 years)</td>
<td>Aseptic loosening/osteolysis</td>
<td>5/20 (25%)</td>
<td>38/130 (29%)</td>
<td>0.796</td>
</tr>
<tr>
<td>Late (&gt;10 years)</td>
<td>Infection</td>
<td>10/33 (30%)</td>
<td>12/138 (9%)</td>
<td>0.002*</td>
</tr>
<tr>
<td>Late (&gt;10 years)</td>
<td>Instability</td>
<td>4/16 (25%)</td>
<td>12/133 (9%)</td>
<td>0.073</td>
</tr>
<tr>
<td>Late (&gt;10 years)</td>
<td>Stiffness</td>
<td>1/10 (10%)</td>
<td>6/76 (8%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Late (&gt;10 years)</td>
<td>Miscellaneous</td>
<td>3/12 (25%)</td>
<td>14/98 (14%)</td>
<td>0.393</td>
</tr>
</tbody>
</table>
Relative Risk Increases EXPONENTIALLY!

Every 1 kg/m² = 10% increase in relative risk of infection

Wagner+ JBJS 2016
Poor After Revision for Infection

Non-Obese

Obese

Follow Up (months)

Percent Free of Revision

Houdek+ JBJS 2015
Just Lose Weight…
Total Joint Replacement ≠ Weight Loss

About 5-35% Loose; 55-80% Same; 5-15% Gain

Ast+ JBJS 2015
Attrition from Weight Reduction Programs

% Retention Rate against Weeks after commencement of program
TKA Complications after Bariatric Surgery

90-day Major... 90-day Minor... VTE Infection Stiffness Medical Transfusion

TKA Morbidly Obese (n=11,294) TKA After Bariatric Surgery (n=219)

Werner+ JOA 2015
Weight Loss Matters AFTER Joint Replacement

![Graph showing weight loss, weight gain, and stable groups over time to revision in years.]

Percent revised

Time to revision (years)

Stable

Weight Gain

Weight Loss
### Are BMI Cut-offs Really an Answer?

<table>
<thead>
<tr>
<th>BMI Cut-off (kg/m²)</th>
<th>Surgery without a Complication</th>
<th>Surgery with a Complication</th>
<th>Denied without a Complication</th>
<th>Denied with a Complication</th>
<th>Positive Predictive Value</th>
<th># of patients needlessly denied surgery for each complication avoided</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>11789 (42.60%)</td>
<td>580 (2.10%)</td>
<td>14485 (52.35%)</td>
<td>817 (2.95%)</td>
<td>5.30%</td>
<td>18</td>
</tr>
<tr>
<td>35</td>
<td>20946 (75.70%)</td>
<td>1074 (3.88%)</td>
<td>5328 (19.25%)</td>
<td>323 (1.17%)</td>
<td>5.70%</td>
<td>16</td>
</tr>
<tr>
<td>40</td>
<td>25126 (90.80%)</td>
<td>1314 (4.75%)</td>
<td>1148 (4.15%)</td>
<td>83 (0.30%)</td>
<td>6.70%</td>
<td>14</td>
</tr>
<tr>
<td>45</td>
<td>26044 (94.12%)</td>
<td>1373 (4.96%)</td>
<td>230 (0.83%)</td>
<td>24 (0.09%)</td>
<td>9.40%</td>
<td>10</td>
</tr>
<tr>
<td>50</td>
<td>26231 (94.80%)</td>
<td>1387 (5.01%)</td>
<td>43 (0.16%)</td>
<td>10 (0.04%)</td>
<td>18.90%</td>
<td>4</td>
</tr>
<tr>
<td>Coin Flip</td>
<td>13137</td>
<td>698.5 (2.52%)</td>
<td>13137</td>
<td>698.5</td>
<td>5.10%</td>
<td>19</td>
</tr>
</tbody>
</table>

Giori, Amanatullah, Gupta, Bowe, and Harris, JBJS 2018
Is BMI Really the Answer?

Wu+ JOA 2016
The Arthritis/Obesity Dilemma

• More and more overweight/obese patients are visiting the orthopaedic surgeon for joint replacement ➔ EXPONENTIAL DEMAND

• They have tried nearly everything to lose weight without success ➔ FRUSTRATION/DENIAL

• Doctors, hospitals, and payers will be reluctant to perform/approve joint replacement surgery for obese patients ➔ COSTS/COMPLICATIONS
Question & Answer
Thank you for attending this evening’s webinar.
A recording of tonight’s presentation will be available in 7-10 days.
You will be notified by email when it is ready for viewing.