Obesity and Transplantation: Trends, Best Practices and Emerging Research

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Robert Wood Johnson University Hospital Transplant Center

Objectives

Obesity and Transplantation

• Discuss current management of obesity by transplant centers
• Review emerging research of obesity and transplantation
• Identify best practices with obese candidates, recipients, and donors

Weight Criteria for Transplant

Transplant Programs

How many use obesity as a criteria for transplantation?
Weight Criteria for Transplant

Transplant Programs

How many use obesity as a criteria for transplantation?

100%

Transplant Dietitian Survey (2014)

Weight Criteria for Transplant

Transplant Programs

How many use obesity as a criteria for transplantation?

100% → Body Mass Index (BMI)

Transplant Dietitian Survey (2014)

Weight Criteria for Transplant

Why?

1. Long-term outcomes
   - Graft failure
   - Patient mortality
2. Short-term complications
   - Wound complications
3. Higher cost
4. Technical challenges
Transplant Obesity in the Literature

**Older Large Database Analyses**
- Negative Impact on Outcomes

**Single Center Studies**
- Mixed Results

**Recent Large Database Analyses**
- Less / No Impact on Outcomes

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**Obesity Pre-Transplant**

**Liver Transplant Recipients**

*The impact of obesity on patient survival in liver transplant recipients: a meta-analysis.*

13 Studies (>74,000 patients)
- No different in mortality b/w obese and control patients
- No difference in mortality when comparing different BMI thresholds
- No differences in survival when BMI was adjusted for ascites

Saab S (2014)

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**Liver Transplant Recipients**

*Diabetes, and not obesity, is associated with lower survival following liver transplantation.*

UNOS Data: 2003 - 2013 (n=57,255)

Results: Obesity alone is not associated with lower post-transplant survival including BMI >40.

Wong (2015)
Obesity Pre-Transplant

Liver Transplant Recipients

- 2002 – 2010 UNOS data
- Underweight, Normal, Overweight, Obese Class I, II, and III
- \( n = 45,551 \)
- Primary Measure
  - 1 year graft failure and patient mortality

“Obese LT recipients do not have increased risk of death or graft loss post-LT”

Obesity Pre-Transplant

Pancreas Transplant Recipients

- 2000 – 2010 UNOS data
- Normal weight and obese (BMI 30-35) recipients
  - SPK (\( n = 5729 \))
  - PAK (\( n = 1400 \))
- Primary Measure
  - 1 year graft failure & patient mortality

PAK
Obesity does not increase risk of graft failure or patient mortality

SPK
Obesity does not increase risk of patient mortality but is associated with a slight increase risk of graft failure
**Obesity Pre-Transplant**

**Kidney Transplant Recipients**

*Kidney transplantation significantly improves patient and graft survival irrespective of BMI (n = 13,526)*

**Results:** No statistical difference in 1- or 5-year mortality is seen in obese or morbidly obese patients compared normal weight patients.

** Obesity Pre-Transplant**

**Kidney Transplant Recipients**

*Recipient obesity and outcomes after kidney transplantation: A Systematic Review and Meta-Analysis (n = 138,081)*

**Conclusion:** “Obese transplant recipients have only a slightly increased risk of graft loss and experience similar survival to recipients with normal BMI.”

** Obesity Pre-Transplant**

**Kidney Transplant Recipients**

*Effects of Obesity on Kidney Transplantation Outcomes: A Systematic Review and Meta-Analysis (n = 9,296)*

**Conclusion:** “Graft loss and death were associated with obesity only in the analysis of studies that evaluated patients who received a kidney graft before year 2000. No association of obesity with graft loss and death was found in the analysis of studies that evaluated patients who received a kidney graft after year 2000.”
Transplant Obesity in the Literature

Older Large Database Analyses → Negative Impact on Outcomes

Recent Large Database Analyses → Less / No Impact on Outcomes

1. Improvement in surgical techniques
2. Better immunosuppression options

1-Year Incidence of Acute Rejection and Graft Survival Since 1960's

Adapted from Stewart F, Organ Transplantation, 1999
Transplant Obesity in the Literature

Single Center Studies → Mixed Results

- No universal guidelines exist for acceptable transplant candidate
  - Each center develops its own selection criteria
  - Each center weighs predictors of poor outcomes differently

Transplant Obesity in the Literature

Does obesity affect transplant outcomes differently in different patient populations?

Scientific Literature

Extremely Limited

Kidney Graft and Patient Survival

3 Year Patient Survival at RWJUH Transplant (7/1/05 – 12/31/07).

- 69% for Age: 50 - 80 years BMI > 35
- 100% for Age: 20 - 50 years BMI > 35
Kidney Graft and Patient Survival

3 Year Patient Survival at RWJUH Transplant (7/1/05 – 12/31/07).

- **69%** Age: 50 - 80 years BMI > 35
- **100%** Age: 20 - 50 years BMI > 35
- **84%** Age: 50 - 80 years Normal Weight

Kidney Graft and Patient Survival

Kidney Transplant Recipients

- 2001 – 2006 UNOS data
- Normal weight and morbidly obese (BMI 35-40)
  - n = 30,132
- Primary Measure
  - 3 year graft failure and patient mortality

Obesity Pre-Transplant

Kidney Transplant Recipients

- 2001 – 2006 UNOS data
- Normal weight and morbidly obese (BMI 35-40)
  - n = 30,132
- Primary Measure
  - 3 year graft failure and patient mortality

Subgroups

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Race/Ethnicity</th>
<th>Functional Status</th>
<th>Diabetes</th>
<th>Dialysis Dependency</th>
<th>Donor Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 – 34</td>
<td>White</td>
<td>No assistance</td>
<td>Non-Diabetic</td>
<td>Non-dialysis</td>
<td>Living Donor</td>
</tr>
<tr>
<td>35 – 49</td>
<td>African American</td>
<td>Some assistance</td>
<td>Diabetic</td>
<td>Dialysis</td>
<td>Deceased Donor</td>
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<tr>
<td>50 – 64</td>
<td>Hispanic</td>
<td>Total assistance</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>65 – 80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pieloch (2014)
Obesity Pre-Transplant

Kidney Transplant

Morbid Obesity (BMI 35 – 40) NO

African American Diabetes Deceased Donor Dialysis Dependent Poor Functional Status Male Age > 65 Years

YES

NO

> 150%
Obesity Pre-Transplant

Study of ~20,000 heart transplant recipients from 1995-2005

| Obesity | BMI 30 – 35 | NO | BMI > 35 | Yes | 18% |

Significantly Increases Risk of Graft Failure & Patient Mortality

- Age >30 years
- Diabetes
- PVD
- COPD
- ICU at Transplant
- VAD
- Previous Transplant

Obesity Pre-Transplant

Study of ~20,000 heart transplant recipients from 1995-2005

| Obesity | BMI 30 – 35 | NO | BMI > 35 | Yes | 18% |

Significantly Increases Risk of Graft Failure & Patient Mortality

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- COPD
- ICU at Transplant
- VAD
- Previous Transplant

Obesity Pre-Transplant

Multi-Center Study of Lung Transplant Recipients (n=546)

Multivariate Analysis

Obesity (BMI > 30) 4%↑ mortality risk

Subgroup Analysis

<table>
<thead>
<tr>
<th>Obese</th>
<th>Normal Weight</th>
<th>Mortality Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPD</td>
<td>VS. COPD</td>
<td>No difference</td>
</tr>
<tr>
<td>ILD</td>
<td>VS. ILD</td>
<td>Obese</td>
</tr>
</tbody>
</table>
### Obesity Pre-Transplant

#### Subgroup vs. Subgroup

**3 Year Graft Survival**

<table>
<thead>
<tr>
<th></th>
<th>Morbidly Obese</th>
<th>Normal Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Dialysis</td>
<td>89.5%</td>
<td>84.0%*</td>
</tr>
<tr>
<td>Living Donor</td>
<td>96.8%</td>
<td>81.6%</td>
</tr>
<tr>
<td>Non-Diabetic</td>
<td>84.1%</td>
<td>81.7%*</td>
</tr>
<tr>
<td>White</td>
<td>83.7%</td>
<td>78.7%*</td>
</tr>
<tr>
<td>No Assistance</td>
<td>83.7%</td>
<td>80.1%</td>
</tr>
<tr>
<td>Age 18 - 34</td>
<td>83.6%</td>
<td>78.1%*</td>
</tr>
<tr>
<td>Age 65 - 80</td>
<td>87.0%</td>
<td>81.7%*</td>
</tr>
</tbody>
</table>

* p<0.01

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#### Multivariate Logistic Regression Analysis – 3 Year Graft Failure

- Morbidly Obese and Non-Dialysis (vs. Normal Weight and Dialysis)
- Morbidly Obese and Living Donor (vs. Normal Weight and Deceased Donor)
- Morbidly Obese and Non-Diabetic (vs. Normal Weight and Diabetic)
- Morbidly Obese and White (vs. Normal Weight and African American)
- Morbidly Obese and No Assistance (vs. Normal Weight and Some Assistance)
- Morbidly Obese and Age 18 - 34 (vs. Normal Weight and Age 65 - 80)

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#### Subgroup vs. Subgroup

**3 Year Patient Survival**

<table>
<thead>
<tr>
<th></th>
<th>Morbidly Obese</th>
<th>Normal Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Dialysis</td>
<td>95.5%</td>
<td>91.7%*</td>
</tr>
<tr>
<td>Living Donor</td>
<td>93.9%</td>
<td>90.0%</td>
</tr>
<tr>
<td>Non-Diabetic</td>
<td>94.0%</td>
<td>87.0%*</td>
</tr>
<tr>
<td>White</td>
<td>91.3%</td>
<td>90.9%</td>
</tr>
<tr>
<td>No Assistance</td>
<td>92.4%</td>
<td>88.0%</td>
</tr>
<tr>
<td>Age 18 - 34</td>
<td>97.8%</td>
<td>82.6%</td>
</tr>
</tbody>
</table>

* p<0.01

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Pieloch (2014)
### Obesity Pre-Transplant

#### Subgroup vs. Subgroup

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<td>91.7%*</td>
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<tr>
<td>Living Donor</td>
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<tr>
<td>Non-Diabetic</td>
<td>94.0%</td>
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<tr>
<td>White</td>
<td>91.3%</td>
<td>90.9%</td>
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<tr>
<td>No Assistance</td>
<td>92.4%</td>
<td>88.0%* Some Assistance</td>
</tr>
</tbody>
</table>

#### 3 Year Patient Survival

<table>
<thead>
<tr>
<th></th>
<th>p=0.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morbidly Obese and Non-Diabetic vs. Normal Weight and Diabetic</td>
<td>94.0% vs. 87.0%*</td>
</tr>
<tr>
<td>Morbidly Obese and Non-Dialysis vs. Normal Weight and Dialysis</td>
<td>95.5% vs. 91.7%*</td>
</tr>
<tr>
<td>Morbidly Obese and Living Donor vs. Normal Weight and Deceased Donor</td>
<td>93.9% vs. 90.0%</td>
</tr>
<tr>
<td>Morbidly Obese and White vs. Normal Weight and African American</td>
<td>91.3% vs. 90.9%</td>
</tr>
<tr>
<td>Morbidly Obese and No Assistance vs. Normal Weight and Some Assistance</td>
<td>92.4% vs. 88.0%*</td>
</tr>
</tbody>
</table>

#### Multivariate Logistic Regression Analysis – 3 Year Patient Mortality

#### Obesity Pre-Kidney Transplant

**RWJUH Transplant**

- 84% vs. 100%
  - Age: 50-80 years
  - Age: 20-50 years

**OPTN/UNOS**

- 87% vs. 97%
  - Age: 50-80 years
  - Age: 20-50 years
Obesity Pre-Transplant

RWJ Internal Analysis

**Good Outcomes**

- Morbidly Obese
- Limited # of Co-morbidities

**Bad Outcomes**

- Morbidly Obese
- Multiple Co-morbidities

Kidney Transplant Morbidity Index (KTMI) Scale

<table>
<thead>
<tr>
<th>Condition</th>
<th>KTMI Points</th>
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</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>1</td>
</tr>
<tr>
<td>CAD</td>
<td>1</td>
</tr>
<tr>
<td>CVD</td>
<td>1</td>
</tr>
<tr>
<td>PVD</td>
<td>1</td>
</tr>
<tr>
<td>BMI (&gt;35)</td>
<td>1</td>
</tr>
<tr>
<td>Previous Transplant</td>
<td>1</td>
</tr>
<tr>
<td>Poor Functional Status</td>
<td>1</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>- &lt;50 years</td>
<td>1</td>
</tr>
<tr>
<td>- 50-64 years</td>
<td>2</td>
</tr>
<tr>
<td>Dialysis Dependency</td>
<td></td>
</tr>
<tr>
<td>- 0-4 years</td>
<td>1</td>
</tr>
<tr>
<td>- &gt; 4 years</td>
<td>2</td>
</tr>
</tbody>
</table>

Total

RWJ Robert Wood Johnson

Pieloch (2014)
**KTMI Study**

- 2000 – 2008 UNOS data
- Kidney transplant recipients
  - n = 100,261
- Primary Measure
  - 3 year graft failure and patient mortality


Hazard Ratio’s for 3 year patient mortality

KTMI Score 1 vs. KTMI Score 0*
KTMI Score 2 vs. KTMI Score 0*
KTMI Score 3 vs. KTMI Score 0*
KTMI Score 4 vs. KTMI Score 0*
KTMI Score 5 vs. KTMI Score 0*
KTMI Score 6 vs. KTMI Score 0*
KTMI Score 7 vs. KTMI Score 0*

KTMI – Kidney Transplant Morbidity Index
* Adjusted for HLA mismatch, cold ischemic time, donor age, and donor type

Weight Criteria for Transplant

What is used to determine transplant candidacy in obese candidates?

2014 Transplant Dietitian Survey Results

Weight Criteria for Transplant

What is used to determine transplant candidacy in obese candidates?

2014 Transplant Dietitian Survey Results
Weight Criteria for Transplant

Why?
1. Long-term outcomes
   - Graft failure
   - Patient mortality
2. Short-term complications
   - Wound complications
3. Higher cost
4. Technical challenges

Transplant Obesity: Costs

Hospital Transplant Admission
- The largest billed charge for transplant recipients
  - Heart – 64%
  - Lung – 54%
  - Liver – 57%
  - Kidney – 35%
  - Pancreas – 37%

LOS is the best predictor of total hospital charges in transplant recipients¹
Kidney Transplant Recipients

- 2000 – 2008 UNOS data
- Normal weight and morbidly obese (n>40,000)
- Primary Measure
  - Prolonged LOS (>7 days)

Morbid Obesity (BMI 35 – 40) Independently Associated with Prolonged LOS
Risk Increases 23%
Transplant Obesity – Costs

Morbid Obesity (BMI 35 – 40)
- Independently Associated with Prolonged LOS
- Risk Increases 23%

African American
CAD
Previous Transplant
Poor Functional Status
DM
Age > 50
Dialysis Dependent
(< 4 years)

Predictive value not significantly different than that of morbid obesity
- Risk Increases 11% - 32%

Deceased Donor

Significantly better predictor of LOS compared to morbid obesity
- Risk Increases 48% - 224%

Transplant Obesity – Costs

Morbid Obesity (BMI 35 – 40)
- Independently Associated with Prolonged LOS
- Risk Increases 23%

African American
CAD
Previous Transplant
Poor Functional Status
DM
Age > 50
Dialysis Dependent
(< 4 years)
Dialysis Dependent
(> 4 years)
Deceased Donor

Significantly better predictor of LOS compared to morbid obesity
- Risk Increases 48% - 224%

Weight Criteria for Transplant

Why?

1. Long-term outcomes
   - Graft failure
   - Patient mortality
2. Short-term complications
   - Wound complications
3. Higher cost
4. Technical challenges
# Weight Criteria for Transplant

<table>
<thead>
<tr>
<th>Organ</th>
<th>Optimal BMI</th>
<th>Considered BMI</th>
<th>Contraindications BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart</td>
<td>&lt;30</td>
<td>30-35</td>
<td>&gt;35</td>
</tr>
<tr>
<td>Lung</td>
<td>19-27</td>
<td>27-30</td>
<td>&gt;30</td>
</tr>
<tr>
<td>Pancreas</td>
<td>&lt;27</td>
<td>28-30</td>
<td>&gt;30&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Kidney</td>
<td>&lt;35</td>
<td>35-40</td>
<td>&gt;40&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Liver</td>
<td>&lt;30</td>
<td>30-40</td>
<td>&gt;40&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

BMI: Body Mass Index.

<sup>a</sup> BMI where many consider bariatric surgery.

<sup>b</sup> Unless bariatric surgery concomitant with transplantation.

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## Obesity Criteria - Kidney Transplant

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Total Centers (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>31</td>
</tr>
<tr>
<td>30-35</td>
<td>1</td>
</tr>
<tr>
<td>36-39</td>
<td>4</td>
</tr>
<tr>
<td>40-42</td>
<td>15</td>
</tr>
<tr>
<td>&gt;42</td>
<td>13</td>
</tr>
</tbody>
</table>

2015 Transplant Dietitian Survey Results

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## Obesity Criteria - Liver Transplant

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Total Centers (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>1</td>
</tr>
<tr>
<td>30-35</td>
<td>15</td>
</tr>
<tr>
<td>36-39</td>
<td>2</td>
</tr>
<tr>
<td>40-42</td>
<td>14</td>
</tr>
<tr>
<td>&gt;42</td>
<td>9</td>
</tr>
</tbody>
</table>

2015 Transplant Dietitian Survey Results
**Obesity Criteria - Heart Transplant**

**Weight Criteria for Transplant**

**Why do we use BMI in Transplant?**
- Simple and inexpensive
- Correlation with body fat
- What’s been studied

**Limitations of BMI**
- Not a tool to determine individual obesity
- Does not distinguish fat, muscle, and water weight
- Does not look at the distribution of fat among individuals

**Obese Transplant Candidates**

**RWJ Obesity Criteria for Kidney Transplant**

<table>
<thead>
<tr>
<th>Prior to 2008</th>
<th>2008 to 2012</th>
<th>2012 to 2013</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO BMI Criteria</td>
<td>BMI &gt; 35</td>
<td>Under Age 65: BMI &gt; 35</td>
<td>NO BMI Criteria</td>
</tr>
</tbody>
</table>

**BMI Criteria**
- BMI ≤ 30
- BMI ≤ 32
- BMI ≤ 34
- BMI ≤ 35
- BMI ≤ 38
- BMI < 40
- BMI not used

**Transplant Centers (n)**

2015 Transplant Dietitian Survey Results
Weight Criteria for Transplant

What does RWJUH use to determine weight limits for kidney transplant?

- Ability to lose weight
- Functional status & exercise capacity
- Sarcopenic obesity
- Dry weight
- Body type & degree of abdominal obesity
- Number of co-morbidities
- “Eye ball test”

Obese Transplant Candidates

Normal BMI but high body fat

High BMI but normal body fat
Obese Transplant Candidates

How are standards of practice in determining weight criteria for transplant changing?

1) Less reliance on BMI

Weight Criteria for Transplant

Kidney transplant programs that use BMI as a contraindication to transplant

2013

99%

ASTS Survey (n=70)
Weight Criteria for Transplant

Kidney transplant programs that use BMI as a contraindication to transplant

2013

ASTS Survey (n=70)

2014

2014 Transplant Dietitian Survey (n= >70)

99%

91%

How are standards of practice in determining weight criteria for transplant changing?

1) Less reliance on BMI

2) Weight criteria's are becoming more liberal
Has your transplant center changed its obesity criteria for transplant in the last 1-2 years?

- About the Same: 65%
- More Liberal: 26%
- More Conservative: 9%

Obese Transplant Candidates

January 2009: Morbidly Obese Patients on the RWJUH Kidney Transplant List

- 70 Patients (BMI > 35)
- 12% of the Kidney Transplant List

Transplant Dietitian Driven Weight Loss Program

- Made inactive (Status 7)
- Individualized diet and exercise program
  - Diet – identified biggest "problem area" and tackled it
  - Exercise – "do something" and have it be structured
- Monthly follow up (phone call)
- Removed from list for weight loss non-compliance
  - Defined as: > 2 Months of unsuccessful weight loss
Obese Transplant Candidates

2009 Weight Loss Program Results

- 87% lost weight
- 61% met their BMI goal
- 25% lost at least 25lbs
- Only 13% were unable to lose weight

BMI <35 - Weight Loss Achieved (n=43)
BMI >35 - Weight Loss Demonstrated (n=18)
BMI >35 - Weight Loss Non-compliance (n=9)

Transplant Dietitians

Accounted for ~6% of total transplant volume in each of the next 3 years

Obese Transplant Candidates

Why Did It Work?

- Increases motivation to lose weight
- Simplicity of weight loss program
- Constant follow up
- Transplant dietitian driven
Obese Transplant Candidates

Referral

Transplant Evaluation Screening

BMI > 37

Not a Candidate

Weight Loss Intervention (Outside of Transplant Center)

BMI ≤ 37

Initial Evaluation Scheduled

Transplant Dietitian

Not a Candidate

Referral

BMI < 37

Initial Evaluation Scheduled

Transplant Dietitian

Initial Evaluation Scheduled

10%

Transplant Dietitians

Referral

Transplant Evaluation Screening

BMI > 37

Not a Candidate

Weight Loss Intervention

BMI ≤ 37

Initial Evaluation Scheduled

Transplant Dietitian

Transplant dietitian given sole discretion in decision making process
Transplant Dietitians

Why was this so successful?

- Using the transplant dietitian to tackle a nutritional issue (obesity)
  - Obesity is not just a BMI number
- Gave the transplant dietitian authority to make decisions regarding patients with nutritional issues
  - Quickly identified good and poor candidates and prioritized

Obese Transplant Candidates

How often do transplant dietitians determine if patients with nutritional issues can receive a transplant evaluation?

- Never/Rarely: 43%
- Sometimes: 22%
- Always/Most of the Time: 31%

2014 Transplant Dietitian Survey Results
What affects transplant outcomes more?

Typical 1 Year Post Transplant Weight Gain

- Kidney  \( \uparrow 3.6\% - 13.9\% \) (body weight)
- Liver  \( \uparrow 9.1 \text{ kg} \)
- Pancreas  \( \uparrow 7.3 \text{ kg} - 11 \text{ kg} \)
- Heart  \( \uparrow 10.3 \text{ kg} \)
- Lung  \( \uparrow 10\% \) (body weight)

Transplant Recipient Focus Group \((n=7)\)

- At least 12% increase in weight at 1 year post transplant

Take Aways:

1. Most everyone wanted help losing weight
2. Steroid induced hyperphagia
3. Fear that exercise would hurt the transplant

References as requested
“The prednisone makes me do it”

Don’t Blame the Steroids: Weight Gain in Kidney Recipients On Corticosteroid-Free Maintenance Immunosuppression.
J. Augustine, N. Sarabu, A. Padiyar, D. Hricik. Medicine, University Hospitals, Cleveland, OH.

Weight Gain Post-Transplant

Prednisone
(5.6±3.6 mg/day) (n=110)

Steroid Free
(n=187)

2 Year Follow Up

BMI 1.8 kg/m²

BMI 1.9 kg/m²

World Transplant Congress Abstract (2014)

“My weight gain is mostly muscle”

“It’s not fat it’s water weight”
Weight Gain Post-Transplant

Kidney Transplant Recipients
- Single center study
  - n = 119
- Primary measures (1 year-post transplant)
  - Body composition
    - bioelectrical impedance assessment (BIA)
  - Dietary History
  - Activity level

Zelle (2013)

Subgroup Analysis
Changes from time of transplant to 1 Year Post

<table>
<thead>
<tr>
<th>Measure</th>
<th>Weight Stable</th>
<th>Weight Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscle Mass</td>
<td>↑ 0.6 kg</td>
<td>↓ 1 kg</td>
</tr>
<tr>
<td>Fat Mass</td>
<td>↑ 1.6 kg</td>
<td>↑ 5.4 kg</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>↓ 0.3 mmol/L</td>
<td>↑ 0.7 mmol/L*</td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td>↓ 0.7 mmol/L</td>
<td>↑ 0.6 mmol/L*</td>
</tr>
</tbody>
</table>

*p < 0.05

Zelle (2013)
**Weight Gain Post-Transplant Subgroup Analysis**
Comparing lifestyle factors b/w groups

- Energy Intake (kcal/d)
- Total Fat Intake (E%)
- Saturated Fat Intake (E%)
- Cholesterol Intake (kcal/d)
- Carbohydrate Intake (E%)
- Sweet/Salty Snacks (E%)
- Fiber Intake (g/d)

No difference b/w groups

**Weight Gain Post-Transplant**

Study of kidney transplant recipients (n=19) utilizing DEXA scans and calorimetric chambers

Weight Gain Group vs. Non-Weight Gain Group

Energy Intake → Similar
Weight Gain Post-Transplant

Study of kidney transplant recipients (n=19) utilizing DEXA scans and calorimetric chambers

**Weight Gain vs. Non-Weight Gain**

- Energy Intake: Similar
- REE (adjusted for lean body mass): Lower (p < 0.05)
- Physical Activity: Lower (p < 0.05)

Khang (2014)

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**Weight Gain Post-Transplant**

Randomized Trial of Exercise and Dietary Counseling After Liver Transplantation (n=119)

- Control
- < 50% Compliance
- > 50% Compliance

Krasnoff (2006)

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**Obese Transplant Recipients**

How involved are transplant dietitians in helping improve sedentary lifestyles post-transplant

- Never/Rarely: 48%
- Sometimes: 31%
- Always/Most of the Time: 21%

2014 Transplant Dietitian Survey Results
Weight Gain Post-Transplant

- On Average 2-3 lb weight loss
- 36% lose > 10 lbs (Average of 20 lbs)
- 28% gain > 10 lbs (Average of 17 lbs)

Obesity Criteria - Living Kidney Donors

Obesity Criteria - Living Liver Donors
Transplant Dietitians and Living Donors

When is a nutrition evaluation performed by a transplant dietitian?

- **A formal screening process**
- **All donors receive a full nutrition evaluation**
- **MD/RN referral**
- **Donors not seen**

Kidney
Liver

Transplant Centers (n)

Living Donor Evaluation Process

Donor Screening → In-Center Education & Testing → Transplant Nephrologist → CT Angio → Live Donor Selection Team

Transplant Dietitians

Living Donor Evaluation Process

Donor Screening → In-Center Education & Testing → Transplant Nephrologist → CT Angio → Live Donor Selection Team

Transplant Dietitian
Transplant Dietitians and Living Donors

Living Kidney Donors Screened 2012

Figure 1. Living kidney donors screened by the Hospital of the University of Pennsylvania during 2012. Reveals the high attrition rate observed over the evaluation.

Transplant Dietitians

Living Donor Evaluation Process

Living Donor Evaluation Process

Transplant Dietitians

Living Donor Evaluation Process

Stewart 2014
Transplant Dietitians

Living Donor Evaluation Process

Donor Screening

58% Not a Candidate
32% Start Evaluation

Non-Medical Reason
Medical Reason

48% due to Obesity

Stewart 2014

Obese Transplant Donors

Referral

Donor Screening

BMI > 32 Not a Candidate
BMI ≤ 32 Initial Evaluation Scheduled

Transplant Dietitian

Weight Loss Intervention (Outside of Transplant Center)

31% ineligibility rate due to obesity
Obese Transplant Candidates

Referral

Donor Screening

BMI > 32

Not a Candidate

Transplant Dietitian

Initial Evaluation Scheduled

BMI < 32

Weight Loss Intervention

Living Kidney Donor Transplants at RWJ

Transplant Dietitian Involved in Screening Process

NO

BMI > 32 at Screening 7.8%

Living Donor Transplants 2008-2009

Transplant Dietitian Involved in Screening Process

YES

BMI > 32 at Screening 16.1%

Living Donor Transplants 2011-2012

Living Kidney Donor Transplants at RWJ

Transplant Dietitian Involved in Screening Process

NO

BMI > 32 at Screening 7.8%

Living Donor Transplants 2008-2009
**Living Kidney Donor Screenings at RWJ**

**Donor Screening BMI > 32**

- Explain risks of obesity and donation
- Determines weight loss goal for full donor evaluation
- Develop weight loss and exercise plan (typically 10-15 minutes via phone)

**Transplant Dietitian**

- No weight loss – unmotivated
- No weight loss – motivated
- Lost weight - motivated

**1 Month F/U**

- Call back when weight lost
- F/U every 3 months
- F/U every month

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**Heights**

- 47% were inaccurate
- 39% are off by ≥ 1 inch
- 27% were shorter
- 20% were taller

**Weights**

- 31% were off by > 5%
  - Most were heavier than reported
  - Off by average of 14 pounds

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**Case Study – Donor Screening**

- 45 y.o. African American
  - no significant past medical history
- Ht: 5’8” Wt: 250 lbs   BMI: 38
  - “fat mostly in belly”
  - “recently gained 15 lbs”
  - “stopped exercising”
Living Kidney Donors

Weight Loss Counseling
Where do most people get information on weight loss?
• Weight Loss Myths
  – Eat at least 6 small meals throughout the day to help improve metabolism
  – Eating healthy vs. eating to lose weight
  – It’s organic so it has to be good for you
  – Fad diets!
  – Herbal/dietary weight loss supplements work

• Exercise, exercise, exercise!
  – Dieting alone will rarely lead to long-term success
  – Are you exercising for weight loss?
  – Dealing with a patient’s physical limitations

• Tackle the habit not the food!
  – Snacking
  – Sweet eating
  – Eating out too much
  – Eating too much “good” food
**Weight Loss Counseling**

**Key’s to weight loss success!**

- Focus on calories!
  - Portion sizes
  - Should I be hungry?

- Keep it simple!

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**Conclusions**

- The science on obesity and transplant is starting to change. Obesity may not be as big as a factor on transplant outcomes as once thought.

- Clinical transplant professionals have the opportunity to play a greater role in helping obese patients make it to transplant or donation.
Questions?

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