Update on Bariatric Surgery for the Treatment of Morbid Obesity in Adolescents and Teenagers

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Objectives
- No Disclosures
- Discuss current trends in adult and childhood obesity in the US.
- Evaluate the choices for a surgical procedure.
- Discuss expected outcomes for surgical interventions.
- Discuss program development
- Questions.

Definitions: Adult

<table>
<thead>
<tr>
<th>Category</th>
<th>BMI (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>from</td>
<td>to</td>
</tr>
<tr>
<td>Very severely underweight</td>
<td>15.0</td>
</tr>
<tr>
<td>Severely underweight</td>
<td>15-16</td>
</tr>
<tr>
<td>Underweight</td>
<td>16-18.5</td>
</tr>
<tr>
<td>Normal (healthy weight)</td>
<td>18.5-25</td>
</tr>
<tr>
<td>Overweight</td>
<td>25-30</td>
</tr>
<tr>
<td>Obese Class I (Moderate)</td>
<td>≥ 30</td>
</tr>
<tr>
<td>Obese Class II (Severe)</td>
<td>≥ 35</td>
</tr>
<tr>
<td>Obese Class III (Very Severe)</td>
<td>≥ 40</td>
</tr>
</tbody>
</table>

Definitions: Pediatric

- Overweight: BMI between 25-29.9 or defined as a BMI at or above the 85th percentile and lower than the 95th percentile for children of the same age and sex.
- Obese: BMI greater than 30 or BMI above the 95th percentile for children of the same age and sex

EWL%-%Excess weight loss % from Ideal Body Weight
EBL%-%Excess BMI Loss % from BMI of 25

Poverty
Genetics
Race
Education
Access
Role of Fructose
My Patients

The S sisters
- 17 and 18
- 325 and 350 pounds
- BMI 50 and 55
- JD and pseudotumor cerebri

KS
- 16 year old female
- PCOS
- BMI 42

Obesity Rates

(*BMI ≥ 30, or about 30 lbs. overweight for 5’4” person)

1990
- No Data

1999
- 10–14%

2009
- 15–19%

Prevalence of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2012

Prevalence of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2013

Prevalence of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2014

Prevalence of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2015

* Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.
2011 Data-10-17 Year olds

High School Student Obesity 2015

Texas Data

- Obesity 30.9% in 2013.
- Dallas is ranked 130 of 232 counties
- Obesity, physical inactivity and access to exercise opportunities
- 15.6% of high school students in Texas are overweight
- 19.1% of 10-17 year olds in Dallas Metro are either overweight or obese.

Dallas Metro Area

- Total population: 6.5 million
- Under 19 population is 24%: 1.6 million
- 300,000 young people are overweight or obese

Impact of Obesity

- 70-80% chance of becoming overweight or obese adults.
- 2X non-obese adolescents to die prematurely, before age 55, of illness or self-inflicted injury
- Face a 10-20 year shorter life span
- Less Education
- Lower rates of being married
- Lower Household income

Gortmaker et al, NEJM 1993
Impact of Obesity: Medical

- Metabolic Syndrome
- PCOS and other Endocrine
- NAFLD
- Cardiovascular Disorders
- Joint and Skin Disorders
- Malignancy
- Costs

Obesity Facts

- Approximately 17% (or 12.5 million) of children and adolescents aged 2—19 years are obese. (CDC)
- Nearly 33% of children are overweight or obese. (IOM)
- Obesity-related illness carries an annual cost of $190.2 billion. (IOM)

So What is the Solution?

- None
- Societal
- Medical
- Mechanical
- Surgical: Which Procedure?
  - Gastric Bypass
  - Banding
  - Sleeve Gastrectomy

Non-Surgical Interventions

- Diet and behavior modification can help a minority of obese adolescents, the vast majority of these patients go on to become obese adults.

Medications Approved for Chronic Weight Management:

![Image of medications chart]

STOP
**Other Management Strategies**

Reshape Balloon: FDA Approved for Adults
Orbera Balloon: FDA warnings—pancreatitis/overinflation
BMI 30-40
Endoscopic placement and removal, Ulcers and migration issues
No Pediatric approval

**1991 NIH Guidelines for Surgery**

- **BMI > 40 kg/m²**
- **BMI > 35 kg/m²** and co-morbid illness
- **Failed** to have sustained weight loss on supervised weight-reduction programs (6 months)

**Best Practices**

- **BMI > 50 kg/m²** with severe comorbidities (e.g., 2 diabetes, severe sleep apnea, pseudotumor cerebri, severe fatty liver)
- **BMI > 40 kg/m²** with severe comorbidities (e.g., severe sleep apnea, severe hypertension, severe depression, impaired quality of life)

**Gastric Bypass (RYGB)**

- Most common bariatric procedure in U.S.
- Restrictive
- Malabsorptive
- 65-70% EWL @ 2yrs
- 0.5-1% mortality
- ~10% complications
  - Many severe
  - Lowest failure rate
**RYGB in Adolescents**

- Overall complication rate 39%, 16% of patients had moderate or severe sequelae. One patient with beriberi and one death. Lawson ML et al. J Pediatr Surg. 2006
- Major complications-8%, minor complications-15%
  Inge et al. JAMA Pediatr, 2013

**LABG in Adolescents**

- Some long term data.
  – Silberhumer et al. Surg Endosc. 2011
  – More modest %EWL.
  – Significant lean mass loss.
  – Falling out of favor for adults.

**Sleeve Gastrectomy (LSG)**

- Stand alone procedure since 2009
- Increasing share of cases (49% in 2015)
  – Surg Obes Relat Dis. 2015
  – 50-70% EWL @ 2yrs
  – <0.5% mortality
  – ~2-3% complications

**Adjustable Gastric Banding (LAGB)**

- ~50% EWL @ 2yrs
- Meticulous follow-up
- ~0.1% mortality
- ~10% complications
- ~20% failure rate
- National trend against its use (4% of cases in 2012)

**LSG in Adolescents**

- Relatively safe and effective.
  – First US adolescent only cohort.
  – Nadler et al. Surgery 2012
  – German cohort.
  – Nothing longer than 2 year follow up.

**TEEN-LABS**

- Perioperative Outcomes of Adolescents Undergoing Bariatric Surgery
  The Teen-Longitudinal Assessment of Bariatric Surgery (Teen-LABS) Study

- Adolescents/Teenagers low numbers, poor data collection
- Cincinnati, Houston, Columbus, Pittsburgh, Birmingham, NIH
- Prospectively collected data 2007-2011

JAMA 2014
TEEN-LABS Update

November 2015

Weight Loss and Health Status 3 Years after Bariatric Surgery in Adolescents

Thomas H. Inge, M.D., Ph.D., Anita P. Cova-Couvelas, M.D., Todd M. Jenkins, Ph.D., Marc P. Michaels, M.D., Michael A. Heimmen, M.D., Mary L. Brandt, M.D., Caroll M. Harvimon, M.D., Ph.D., Meg H. Zeller, Ph.D., Mike K. Chen, M.D., Shauna A. Xanthakis, M.D., Mary Hanib, M.D., and C. Ralph Buncher, Sc.D., for the TEEN-LABS Consortium®

TEEN-LABS—242 patients

Table 1: Demographic, Anthropometric, and Preoperative Characteristics of the Participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. Participants</th>
<th>Gender (N=138)</th>
<th>Race (N=141)</th>
<th>BMI (N=140)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age: 11–17</td>
<td>101 (78%)</td>
<td>74 (64)</td>
<td>88 (62)</td>
<td>54 (38)</td>
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<tr>
<td>18–21</td>
<td>135 (92%)</td>
<td>57 (43)</td>
<td>53 (38)</td>
<td>38 (27)</td>
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<tr>
<td>Weight (kg)</td>
<td>65.6 ± 14.4</td>
<td>55.2 (47)</td>
<td>50.9 (39)</td>
<td>40.2 (29)</td>
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<tr>
<td>Height (cm)</td>
<td>156.8 ± 10.0</td>
<td>155.2 (47)</td>
<td>155.6 (44)</td>
<td>153.4 (41)</td>
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<tr>
<td>Body mass index</td>
<td>25.3 ± 4.7</td>
<td>23.0 (47)</td>
<td>23.9 (44)</td>
<td>24.4 (41)</td>
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<tr>
<td>Preoperative complications</td>
<td>1 (0.4%)</td>
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<td>Major complications</td>
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</tbody>
</table>
Sleeve Gastrectomy

- Safer
- Shorter Operative Time
- No rearrangement of intestinal tract
- Fewer nutritional deficiencies
- Can be converted to bypass if needed
- Nearly similar weight loss profile

Dallas Program—Jan 2016

<table>
<thead>
<tr>
<th>Total Referrals/Operations</th>
<th>171 Referrals, 28 procedures, 20 pending</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at Surgery</td>
<td>16.1 ± 1.06 (range 15-19)</td>
</tr>
<tr>
<td>Female</td>
<td>78%</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>50% C: 32% AA: 18% H:</td>
</tr>
<tr>
<td>Length of Stay (days)</td>
<td>1.7 ± 0.9</td>
</tr>
<tr>
<td>Surgical complications</td>
<td>1 Bleed, Takeback POD1</td>
</tr>
<tr>
<td></td>
<td>1 Thrombophlebitis</td>
</tr>
<tr>
<td>Other re-admissions</td>
<td>2 protracted emesis ➔ EGD</td>
</tr>
<tr>
<td></td>
<td>1 emesis ➔ IVF</td>
</tr>
<tr>
<td></td>
<td>1 dehydration</td>
</tr>
<tr>
<td></td>
<td>1 vasovagal episode</td>
</tr>
</tbody>
</table>

Dallas Program—Outcomes

<table>
<thead>
<tr>
<th></th>
<th>#</th>
<th>Weight KG</th>
<th>EWL%</th>
<th>BMI Kg/m²</th>
<th>EBL%</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOS</td>
<td>28</td>
<td>137±20</td>
<td>NA</td>
<td>49±7</td>
<td>NA</td>
</tr>
<tr>
<td>3 months</td>
<td>20</td>
<td>116±20</td>
<td>23±19</td>
<td>43±7</td>
<td>21±7</td>
</tr>
<tr>
<td>6 months</td>
<td>15</td>
<td>111±21</td>
<td>26±21</td>
<td>43±7</td>
<td>24±7</td>
</tr>
<tr>
<td>1 year</td>
<td>4</td>
<td>103±16</td>
<td>34±16</td>
<td>40±3</td>
<td>39±3</td>
</tr>
</tbody>
</table>

EWL% Excess Weight Loss
EBL% Excess BMI Loss
Comorbid Conditions

<table>
<thead>
<tr>
<th>Comorbid Conditions</th>
<th>Preop</th>
<th>Resolved/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>34%</td>
<td>55% (&lt;2 months)</td>
</tr>
<tr>
<td>HTN</td>
<td>31%</td>
<td>88% (&lt;3 months)</td>
</tr>
<tr>
<td>OSA</td>
<td>46%</td>
<td>Retesting at 1 yr</td>
</tr>
</tbody>
</table>

Weight Change Over Time

BMI Change Over Time

So Surgery for Obese Children?

- Obesity Increasing
- No Good Alternatives
- Good data and good safety profile
- Exponential Growth in availability of procedure…..

Trends in Adolescent Surgery

- No change between 2006-2012
- Comorbidities increased, Length of stay diminished
- Lack of sufficient evidence base.
  - Bariatric Surgery- ~20,000 references
  - Adolescent Bariatric Surgery- ~2500
- Complication rates and risks remain undefined
- Long term >10 yrs data unclear
Pediatric Health Care Provider Perceptions of Weight Loss Surgery in Adolescents

- >45% Do not measure BMI
- <10% refer for weight loss surgery
- Cost risk
- Complication risk
- "no indication in pediatrics"
- 27% did not know surgery was an option
- 66% would like to attempt non-surgical intervention first
- Obesity is a "social" problem not a disease

Why is there no change in numbers?

- Perceptions
- Education
- Significant ethical concerns

Why is there no change in numbers?

- Perceptions
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- Significant ethical concerns

Position Paper

State Intervention in Life-Threatening Childhood Obesity

An increasing proportion of US children are so severely obese as to be at immediate risk for life-threatening complications including type 2 diabetes.

Child protective services typically provide intermediate options such as in-home social supports, parenting training, counseling, and financial assistance, that may address underlying problems.

In some instances, support services may be insufficient to prevent severe harm, leaving foster care or bariatric surgery as the only alternatives.

Although removal of the child from the home can cause families great emotional pain, this option lacks the physical risks of bariatric surgery.

So What is the Solution?

- Societal
  - 43% reduction in obesity in 2-5 year old
  - What about the currently obese generation?
  - Currently the only solution is surgery....

Keys to Success

- Multidisciplinary Team (UTSW and CMC)
- Volume
- Institutional support and infrastructure
- Education and Research Opportunities
- On Protocol for long term follow up
- Contribute to TEEN-LABS
- Adult program in place

Multidisciplinary Team

- Surgeon (2-3 Visits)
- Obesity Clinic (medical management)
- Endocrinologist
- Designated Advanced Practice Providers
- Cardiologist
- Psychologist
- Social Work
- Dietitian
- Anesthesia Team
- GI Specialist
- Pulmonology/Sleep Specialist
- Research Coordinators
Stakeholders

- Patients and Families
- Pediatric Physicians
- Pediatric Surgery Anesthesia
- UTSW Pediatrics (Endocrinology, Cardiology)
- Children’s Medical Center Board, Executives, Nursing, Nutrition, Psychology
- Patients and Families Payers, Referring Physicians
- Bariatric Surgical Center
- Medical Obesity Program
- External Regulators
- Research Funding Agencies

SWOT Analysis

**Strengths:**
- Historical success in program development at institutional and personal level
- Patient volume is high, so surgical program can be successful
- Strong resources
- Strong medical obesity program
- Strong Children’s support at administrative and faculty level
- Surgical Expertise

**Weaknesses:**
- Inconsistent support of surgical procedure amongst medical practitioners
- Institutional structural reconfiguration for bariatric program
- Budget constraints
- Special training for operating room staff, recovery room and surgical floor nurses

**Opportunities:**
- Strong research history at university
- Unique opportunity to collaborate between divisions within institution
- Can become a leader in surgical obesity with a single full service obesity program in the city
- Improve lives of young people in the city
- Expansion to other campuses

**Threats:**
- Failure of institutional support
- Failure of collaboration between medical and surgical groups
- Failure of collaboration between surgical and medical groups in the treatment of obesity
- Failure of adult surgeons into bariatrics for children at other institutions
- Entry of other children’s hospitals into this space

Patient Characteristics

- Age over 14
- 6 months attempt at weight loss
- Multidisciplinary evaluation
- Can assent

Preoperative Evaluation

- No weight loss required
- Preoperative Liquid diet
- Radiology as indicated
- Cardiology as indicated
- Sleep study as indicated
- Average time to OR 6 months

Infrastructural needs

- Free Standing Children’s Institute
- Bariatric Furniture in waiting room, clinic and inpatient
- Appropriate Toilet Fixtures
- Appropriate weight limit and size table in OR
- CT scan 300kg
- Fluoroscopy 250kg (usually upright)

Preoperative Checklist

- Multidisciplinary Team Required

Post Operative Diet

<table>
<thead>
<tr>
<th>Table 1. Diet Stage Progression for BSTR and VLG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stages</td>
</tr>
<tr>
<td>Stage I (Post-operative days 1-3)</td>
</tr>
<tr>
<td>Stage II (Post-operative days 4-5)</td>
</tr>
<tr>
<td>Stage III (Post-operative days 6-7)</td>
</tr>
</tbody>
</table>

| Stage I  | Post-operative days 1-3 | Clear liquids, solid foods with minimal residue, minimal residue formulas |
| Stage II | Post-operative days 4-5  | Solid foods, soft foods, textured foods, low residue formulas             |
| Stage III| Post-operative days 6-7  | Normal foods, high residue formulas                                       |

Post Operative Supplements

- Supplement: Calcium with vitamin D
  - 1,500 EPA
  - 3 capsules provide by hour

- Multivitamin:
  - Contains essential vitamins and minerals
  - Sufficient for most patients

- Vitamin D:
  - 500 IU (includes recommended dose)
  - Sufficient for most patients

Pre and Post Operative Nutrition Surveillance

- Table 4. Pre-MIS and Post-MIS Nutrient Biochemical Surveillance
  - Characteristics
  - Postoperative 2 months
  - Postoperative 6 months
  - Postoperative 1 year

- Table 5. Pre-MIS and Post-MIS Nutrient Biochemical Surveillance
  - Characteristics
  - Postoperative 2 months
  - Postoperative 6 months
  - Postoperative 1 year

- Table 6. Pre-MIS and Post-MIS Nutrient Biochemical Surveillance
  - Characteristics
  - Postoperative 2 months
  - Postoperative 6 months
  - Postoperative 1 year

- Multidisciplinary Team Required

My Patients

- The S sisters
  - 17 and 18
  - 325 and 350 pounds
  - BMI 50 and 55
  - JD and pseudotumor cerebri

- KS
  - 16 year old female
  - PCOS
  - BMI 42

Baseline BMI and Weight Loss Surgery

- Figure 2: Percent Change in BMI from Baseline BMI Classification and Follow-Up Visit
  - BMI Classification
  - Follow-Up Visit
  - 1 year
  - 6 months
  - 1 year

Who is a Better Candidate?


Inge et al, J Peds 2010

Encourage medical follow up scheduling weekly, clinically significant weight loss, and patient satisfaction.

Healthy solid food diet

Healthy and balanced diet consisting of adequate proteins, fats, vegetables, and carbohydrates maintaining ideal body weight and age.
My Patients

The S sisters  
KS
- 17 and 18  
- 325 and 350 pounds  
- BMI 50 and 55  
- BMI now 40 and 42  
- Asymptomatic but still obese

A generation (or two) with obesity
No effective non surgical therapy
Not enough reports
Not Enough procedures
- Belief systems
- Access
- No FDA approval for new devices

Summary

Absolutely but with:
- Age > 14, Weight >95th percentile
- BMI >35 with comorbid, BMI > 40 without
- Earlier referral, healthy obese
- Willing to make behavioral changes.
- Multidisciplinary evaluation
- Standardized protocol
- Complete support of institution

Faisal.quiresi@utsouthwestern.edu
EPIC referral to bariatrics
Personal Thoughts

- Surgery is only a tool
- Not of last resort
- Patients have to do the hard work
- There is a tipping point
- Aha moment

Conclusion-No Adolescents Unless...

- Multidisciplinary evaluation
  - Pratt et al. Obesity 2009
- Standardized protocol with intent to follow patients for 5 years and publish data.
- Mental health provider and dietician with pediatric expertise/training.
  - Zeller et al. Surg Obes Relat Dis. 2011

Cost savings

- Cost made up within 5 years in UK study
  - But recent Swedish and VA study did not show cost benefits
Primary Care

- Reset your internal criteria
- Review your own practice statistics
- Start documenting BMI
- Start documenting efforts at weight control
- Evaluate for complications of obesity
- Critical partners for co-morbidity resolution
- Reach out often

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Medical or Surgical Management

Mean age 44, BMI 48, 88% female, 412 patients
- 1.5 kg loss for wait listed
- 4 kg loss for medical management
- 22 EWL Surgical
- Co-morbid conditions improved dramatically with Surgery

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Saudi Experience

![Graph showing BMI and weight changes](image)

**Fig. 2.** BMI and height changes obtained by children and adolescents postepipanseroscopic sleeve gastrostomy.
The Efficacy of Laparoscopic Sleeve Gastrectomy in Treating Adolescent Obesity

Salahuddin R, Misbahuddin M, Aishah N
Hospital A, Baniyas - Dubai - UAE

135 Patients
72% female
Median age 19 (12-21)

<table>
<thead>
<tr>
<th>Time after surgery</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 months</td>
<td></td>
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</tr>
</tbody>
</table>

### Table 1: Change in weight over follow-up intervals

<table>
<thead>
<tr>
<th>Post-operative follow-up</th>
<th>Pre-op</th>
<th>2 weeks</th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
<th>18 months</th>
<th>24 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight loss (kg)</td>
<td>0.8</td>
<td>5.0</td>
<td>9.6</td>
<td>23.6</td>
<td>32.0</td>
<td>36.6</td>
<td>40.8</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>44.5</td>
<td>46.1</td>
<td>51.3</td>
<td>36.2</td>
<td>31.1</td>
<td>30.7</td>
<td>30.8</td>
</tr>
<tr>
<td>Percent change in BMI²</td>
<td>-0.9</td>
<td>-1.9</td>
<td>-2.9</td>
<td>-3.9</td>
<td>-5.9</td>
<td>-7.9</td>
<td>-8.2</td>
</tr>
</tbody>
</table>

Percent change in weight loss

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