**Outline**

- Definition of obesity in adults and children
- Breadth of problem
- Health effects and associated costs
- Contributing factors
- Treatment options and results
- What is being done now for children
- What are we doing at CHoR at VCU
- Final thoughts

**Defining Pediatric Overweight: Body Mass Index (BMI)**

\[
\text{BMI} = \frac{\text{Weight (kg)}}{(\text{Height (m)})^2}
\]

\[
\text{BMI} = \frac{\text{Weight (lb)}}{(\text{Height (in)})^2} \times 703
\]

- A reliable indicator of body fatness
- Inexpensive and easy to perform
- Recommended screening test in children beginning at age 2 years

[www.cdc.gov/healthyweight/assessing/bmi/childrens_BMI/about_childrens_BMI.html](http://www.cdc.gov/healthyweight/assessing/bmi/childrens_BMI/about_childrens_BMI.html)
Terminology for BMI Categories

<table>
<thead>
<tr>
<th>BMI Category</th>
<th>Previous Terminology</th>
<th>Recommended Terminology</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5th percentile</td>
<td>Underweight</td>
<td>Underweight</td>
</tr>
<tr>
<td>5th-84th percentile</td>
<td>Healthy weight</td>
<td>Healthy weight</td>
</tr>
<tr>
<td>85th-94th percentile</td>
<td>At risk of overweight</td>
<td>Overweight</td>
</tr>
<tr>
<td>≥95th percentile</td>
<td>Overweight</td>
<td>Obese</td>
</tr>
</tbody>
</table>

BMI >30 kg/m²
Severe obesity: BMI >95th percentile


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

Source: Behavioral Risk Factor Surveillance System, CDC.

Prevalence of Overweight in U.S. Children (NHANES 2009-2010)

BMI for Age ≥85th Percentile

Obesity: The Perfect Storm

Conditions Associated with Pediatric Overweight and Obesity

- Type 2 DM
- Hypertension
- Hyperlipidemia
- Pseudotumor cerebri
- Gastroesophageal reflux disease (GERD)
- Nonalcoholic fatty liver disease (NAFLD)
- Cholelithiasis
- Polycystic ovary syndrome (PCOS)
- Venous stasis
- Sleep disordered breathing
- Early degenerative joint disease
- Slipped capital femoral epiphysis
- Blount’s disease
- Focal segmental glomerulosclerosis (FSGS)
- Stress incontinence
- Depression

Staged Treatment of Pediatric Weight Management

- **Prevention (ALL Patients)**
  - Primary care setting
- **Stage 1: Prevention Plus** (BMI ≥ 85th percentile)
  - Primary care setting
  - MONTHLY visits for 3-6 months
- **Stage 2: Structured Weight Management**
  - Primary care setting + Registered dietitian
  - MONTHLY visits for 3-6 months
- **Stage 3: Comprehensive Multidisciplinary Intervention**
  - Multidisciplinary obesity care team
- **Stage 4: Tertiary Care Intervention**
  - (BMI >95th percentile and multiple co-morbidities)
  - Specialized pediatric obesity treatment center

Treatment Options for Obesity

- Behavior modification
  - Dietary changes
  - Physical activity
  - Behavioral support
- Medications
- Weight Loss (Bariatric) Surgery

Medications and weight loss surgery are most effective when added to ongoing lifestyle changes.

Weight Loss Medications

- Associated with modest weight loss (4-10 kg)
- Weight regain after stopping medication
- Limited experience in the pediatric population

Weight Loss Surgery in Children

May be part of an ongoing comprehensive treatment plan in adolescents with severe obesity and weight-related health problems who have not experienced sufficient weight loss with lifestyle changes alone.
Treatment of Pediatric Obesity:
Meta-Analysis of Randomized Trials


(n = 61 trials)

When to Consider Adolescent Bariatric Surgery

Serious Comorbidities:
- Type 2 diabetes
- Severe sleep apnea
- Non-alcoholic fatty liver disease
- Parasuicidal conditions

Less Serious Comorbidities:
- Hypertension
- Elevated cholesterol
- Insulin resistance
- Polycystic ovary syndrome
- Sleep apnea
- Severely impaired quality of life

> 6 Months Participation of Supervised Lifestyle Modification Program

BMI >= 35 kg/m^2

Serious Comorbidity?

BMI > 40 kg/m^2

Less Serious Comorbidity?

Continue Non-Surgical Program

Consider Bariatric Surgery

Weight Loss Surgery in Adolescents

- Should be performed in specialized pediatric centers after a comprehensive evaluation
  - Pediatric specialist
  - Surgeon
  - Registered dietitian
  - Health psychologist
- Generally only considered in adolescents who are physically mature and can understand the risks and benefits of surgery
- Requires treatment of depression/anxiety, eating disorders, and substance abuse before surgery
- Requires lifelong follow-up
Surgical procedures

- Lap gastric bypass
- Lap gastric sleeve resection
- Lap adjustable gastric band
- Other(s)

Roux-en-Y gastric bypass

- Laparoscopic
- Most frequently performed bariatric procedure
- Mean excess weight loss at 1 year of 67%
- No implanted medical device
- Low rate of complications

Vertical sleeve gastrectomy

- Laparoscopic
- Becoming the preferred option for many bariatric surgeons and their patients
- Mean excess weight loss at 1 year of 59%
- No implanted medical device
Meta-analyses of adult bariatric surgery

  - mortality for restrictive procedures is 0.1% and malabsorptive is 0.5 to 1.1%
  - significant EWL and reduction of comorbidities
  - mortality <1%
  - improved results with surgery
  - comorbidities are improved
  - early mortality with lap bands was ≤0.1%

Meta-analyses of adult bariatric surgery

  - %EWL was 49.4% for LAGB and 62.6% for GBP
  - surgery is more effective than conventional management for patients with moderate (BMI>30) and severe obesity (BMI >40)

Bariatric surgery versus intensive medical therapy in obese patients with diabetes

*By Schauer PR, et al. NEJM* 2012;366:1567-76*

- Weight loss was -5.4kg, -29.4kg, and -25.1kg, respectively
- Use of meds to lower glucose, lipid, and BP levels were lowered in both surgical groups but increased in the medical group
- Medical therapy with bariatric surgery was superior to medical therapy alone at 12 months
Bariatric surgery versus intensive medical therapy in obese patients with diabetes

By Schauer PR et al. NEJM 2012;366:1567-76.

- Randomized, nonblinded study looking at intensive medical therapy vs medical therapy & bariatric surgery in 150 obese patients
- Primary endpoint was proportion of patients with glycated Hb level of ≤6.0% at 12 months after treatment.
- Medical = 12%, GBP = 42%, and sleeve = 37%
- Mean glycated levels were 7.5%, 6.4%, and 6.6%, respectively


Bariatric surgery versus intensive medical therapy for diabetes – 3 year outcomes

- Demonstrated even more of a benefit for bariatric surgery compared with medical management

Bariatric surgery for adolescent patients
Benefits of bariatric surgery in adolescent period

- Metabolic and nutritional status changes after 10% weight loss in lap GBP patients vs medically treated – del Genio 2007
- Psychosocial functioning improves – Zeller 2009
- There is a significant increase in health-related QOL after bariatric surgery – Loux 2008
- Reversibility of cardiac abnormalities in morbidly obese adolescents – Ippisch 2008
- Reversal of type 2 diabetes mellitus and improvements in cardiovascular risk factors after surgical weight loss in adolescents – Inge 2009

Argument to NOT wait for surgery

- Five-year transitional period from adolescent to adult period is notable for a high percentage of patients becoming and remaining obese – Gordon-Larsen 2004
- Results for adolescents may be better than adults – Varela 2007
- Baseline BMI is a strong predictor – Inge 2010
- Children with BMI of >99th P who have shown no improvement with weight loss interventions should be referred to pediatric tertiary wt mgmt center with multidisciplinary team – Barlow 2007

Bariatric surgery in adolescents – Meta-analysis


- Comprehensive review of 15 databases resulted in 18 studies meeting inclusion criteria, which included 641 patients
- A variety of operations were utilized
- Mean age was 16.8 years (9 to 21 years)
- BMI reductions were sustained and clinically significant for both LAGB and RYGB
- Resolution of comorbidities such as DM and HTN
- Minor and major surgical complications can occur
Adolescent laparoscopic gastric sleeve resection


- Prospective case series of 23 adolescents (mean age of 17.3 yo) with mean BMI of 52 ± 9 kg/m² that underwent a laparoscopic gastric sleeve resection
- No intraoperative complications and only one relatively minor complication
- Mean LOS was 2.2 ± 1.1 days and mean FU was 10.9 ± 7.4 months
- Mean EWL was 38% and 40% at 6 and 12 months, respectively
- Good resolution of comorbidities

Are there other surgical options?

Adjustable gastric band

- Laparoscopic
- Second most frequently performed bariatric procedure
- Mean excess weight loss at 1 year of 42%
- Requires implanted medical device
- Lowest rate of complications
Lap band data at 5 years in adolescent patients

Laparoscopic gastric plication

- Laparoscopic
- No suture / staple lines
- Mean excess weight loss at 1 year of 61%
- No implanted medical device
- Is thought to be reversible
- Will enroll 30 patients over 3 years

Laparoscopic gastric plication for treatment of severe obesity

- Compared anterior to greater curvature plication in 15 patients at the Cleveland Clinic
- Average preop BMI was 43.3
- EWL was 53.4% at 1 year

Twelve year experience of laparoscopic gastric plication in morbid obesity: development of the technique and patient outcomes


- Reviewed their 12-year experience with gastric plication – most (644) were two-row plications
- Average preop BMI was 42.1
- EWL was 70% at 2 years and 55% after 5 years
- Complication rate was 1.6%
- 9 of the patients were adolescents

Laparoscopic gastric plication in morbidly obese adolescent patients


- Evaluate the safety and efficacy of lap plication amongst severely obese adolescents
- 12 patients with mean age of 13.8 years and BMI of 46
- Mean EWL was 68.2% after 2 years
- All medical comorbidities were improved after the operation
- One patient required reoperation but no other complications

Our experience
Healthy Lifestyles Center

- Provides comprehensive, family-based care for obese children and adolescents that have not responded to treatment in the primary care setting

- Core areas include:
  - Psychology / Behavior Modification
  - Exercise Physiology
  - Nutrition
  - Pediatric Medicine
  - Pediatric Surgery
  - Research / Biostatistics

Lap Gastric Sleeve Resection

- NW, 18yo female with a BMI of 43
- Comorbidities included insulin resistance and PCOS
- Operation done on July 2013
- Has lost almost 20 kg
Lap Gastric Plication

- RW, 17yo female with a BMI of 40
  - Comorbidities: pseudotumor c.
  - Operation done this past Dec
  - Now has BMI of 34
- AG, 17yo female with a BMI of 44
  - Comorbidities: insulin resistance
  - Operation done last month
  - Now has BMI of 38

Plication video?

Conclusions

- Bariatric surgery may be the best option for many morbidly obese adolescents
- The majority of comorbidities improve, if not resolve, with bariatric surgery
- Waiting until morbidly obese children become 18yo may result in permanent health consequences
- Multiple questions need to be studied in clinical trials at an academic center in a program like the Healthy Lifestyles Center with strong multidisciplinary support
Hypothesis

Surgery performed in the adolescent period is a more effective treatment for juvenile-onset morbid obesity compared to surgery delayed until adulthood

Questions?