VERITAS COLLABORATIVE

A SPECIALTY HEALTHCARE SYSTEM FOR THE TREATMENT OF EATING DISORDERS

DURHAM, NC | CHARLOTTE, NC | RICHMOND, VA | ATLANTA, GA
855.875.5812 | VERITASCOLLABORATIVE.COM
MEDICAL COMPLICATIONS OF EATING DISORDERS IN CHILDREN AND ADOLESCENTS

Anna B. Tanner, MD, FAAP, FSAHM, CEDS

Vice President, Medical Services, Veritas Collaborative

Adjunct Assistant Professor of Pediatrics, Emory University School of Medicine
Disclosure of Potential Conflicts of Interest

East Tennessee State University’s Quillen College of Medicine, Office of Continuing Medical Education (OCME) holds the standard that its continuing medical education programs should be free of commercial bias and conflict of interest. The OCME requires each presenter and planning committee member to disclose all financial affiliations with commercial interests.

A commercial interest is any entity producing, marketing, re-selling, or distributing healthcare goods or services consumed by, or used on, patients.

It is the policy of the OCME to disclose all commercial support received for each educational activity. This activity has received NO commercial support through educational grants or vendor fees.

The following individuals have provided disclosure of potential conflicts of interest as noted:

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
<th>Self/Spouse</th>
<th>Name of Commercial Interest</th>
<th>Nature of Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gayatri Jaishankar, MD FAAP</td>
<td>Co-Activity Director</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>William Dodd, MD</td>
<td>Co-Activity Director</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Dawn Tuell, MD (Dept Chair)</td>
<td>Planning Committee Member</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Donna Dougherty, BS</td>
<td>Planning Committee Member</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Anna Tanner, MD, FAAP, FSAHM, CEDS</td>
<td>Speaker</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

Wednesday, March 11, 2020
“Medical Complications of Eating Disorders”

Pediatric Grand Rounds
Learning Objectives

• Recognize that eating disorders are a mental illness with serious medical complications that affect the whole body
• Describe how to diagnose an eating disorder and how to perform a targeted history and physical exam
• Manage the most serious medical complications of eating disorders
Why learn about eating disorders?

- Eating Disorders are lethal psychiatric illnesses
- Mortality is most often due to the complications of starvation
- Eating disorders have medical consequences that often go unrecognized but can affect every organ system in the body
- Eating disorders can have “potentially irreversible effects ...on physical and emotional growth and development in adolescents”

Remember that eating disorders:

- Are not willful behavior, but are serious mental illnesses
- Can be present in people at normal weight
- Can affect persons of all genders and gender identities, adolescents and adults, and people of all ethnicities and backgrounds
- Can present in children and adolescents as abnormal growth or delayed or interrupted puberty
Anorexia Nervosa (AN) affects an estimated 0.5% to 1% of adolescent girls in the U.S.

Bulimia Nervosa (BN) affects an estimated 1% to 2% of adolescent girls in the U.S.

Other eating disorders affect an estimated 14% of the population

Median age of onset is 12 to 13 years old

Eating disorders are the third most common chronic disease during adolescence

Increasing incidence of anorexia nervosa in patients with a previous history of obesity

Higher rates of eating disorders now seen in younger children, boys, LGBT and minority groups
MEN STARVE IN MINNESOTA

CONSCIENTIOUS OBJECTORS VOLUNTEER FOR STRICT HUNGER TESTS TO STUDY EUROPE'S FOOD PROBLEM
Effects of Extreme Weight Loss

Ancel Keys and colleagues, *The Biology of Human Starvation*

- Faced the problem of refeeding civilians who had been starved during the war
- Cited still by researchers exploring effects of food deprivation in patients with eating disorders

Physical and psychological effects of extreme weight loss defined by the study

- Nutrition directly affects mind as well as body
- Starvation dramatically alters personality
  - Irritability
  - Neurologic deficits
  - Obsessional thinking about food and weight
- Human body is mutable
  - Changes in heart rate and blood pressure
  - Anemia and edema
  - Fatigue and extreme weakness
- Recovery from malnourished state is a long-term process physically
- Psychological manifestations of altered hunger/fullness cues and deprivation are longer lasting
DSM-5 Eating Disorder Classifications

Anorexia Nervosa
Bulimia Nervosa
Binge-Eating Disorder
Avoidant/Restrictive Food Intake Disorder (ARFID)
Pica
Rumination Disorder
Other Specified Feeding or Eating Disorder (OSFED)
  • Atypical Anorexia Nervosa
  • Bulimia Nervosa (of low frequency and/or limited duration)
  • Binge-Eating disorder (of low frequency and/or limited duration)
  • Purging disorder
Unspecified Feeding or Eating Disorder (UFED)
Contrasting Psychological Symptoms

Anorexia Nervosa

- **Ego-syntonic illness** - patients do not want to give up what they see as acceptable behavior
- Intense fear of gaining weight
- Body image distortion
  - Makes maintaining healthy weight uncomfortable or intolerable
  - Drives fears of weight gain, discomfort with weight and wishes to lose weight
- Denial of seriousness of the illness

Bulimia Nervosa

- **Ego-dystonic illness** - patients do not want their illness, often experience “shame”
- Repeated episodes of binge eating
- Inappropriate compensatory behaviors to prevent weight gain
  - Drives vomiting, purging, and restricting behaviors
- Self-evaluation is unduly influenced by weight and shape
Presenting Concerns of Eating Disorders

Patient may state or parent may note:

– Excessive concern over weight
– Inappropriate dieting
– Pattern of weight loss
– Amenorrhea, primary or secondary
– Failure to achieve appropriate increases in weight or height in a growing child
### Presenting Medical Symptoms

#### Anorexia Nervosa
- Weight loss
- Amenorrhea
- Dizziness/syncope
- Chest pain/palpitations
- Seizures
- Fatigue/weakness
- Abdominal pain/constipation
- Spontaneous or low impact fractures
- Hair loss
- Dry skin
- Cold intolerance

#### Bulimia Nervosa
- Irregular menses
- Palpitations
- Acid reflux
- Fatigue/weakness
- Constipation or diarrhea
- Upper and/or lower extremity edema
- Frequent sore throat
- Sensitive teeth
- Swollen cheeks
Screening for Eating Disorders

**SCOFF Questionnaire**

- 1. Do you make yourself **sick** because you feel uncomfortably full?
- 2. Do you worry you have lost **control** over how much you eat?
- 3. Have you recently lost **one** stone (about 14 pounds) in a 3-month period?
- 4. Do you believe yourself to be **fat** when others say you are too thin?
- 5. Would you say that **food** dominates your life?

**Bright Futures, AAP**

- How do you feel about your present weight?
- How much would you like to weigh?
• Rule out other disorders
• Evaluate the patient’s medical, nutritional, and psychosocial status
• Determine severity of the condition
• Make plan of care
Differential Diagnosis

• Gastrointestinal disorders such as Inflammatory bowel disease, celiac disease, or infectious diarrhea
• Chronic infections such as HIV infection, or tuberculosis
• Endocrine disorders such as hyperthyroidism, diabetes mellitus, or adrenal insufficiency
• Psychiatric disorders - depression, OCD, or anxiety
• Substance abuse
• Central nervous system tumors (such as prolactinoma)
• Malignancies
• Rheumatologic disease
• Other
Comprehensive History

Targeted History

• Weight history: Highest, lowest, current, ideal
• Exercise history: How much/often? Feelings about missed work-outs?
• Current eating habits especially recent changes or 24-hour dietary recall
• Binge eating and/or purging history

Past Medical History

• Family history: Eating disorders, Depression, Bipolar, Anxiety
• Puberty and Growth: Growth hx, onset of menarche or shaving

Social History

• Family function and resources – divorce, work, transportation
• Use of cigarettes, drugs or alcohol
• History of abuse – physical, emotional, verbal, sexual
• Psychiatric symptoms especially suicidality
Medical Evaluation

Collect vital signs
- Measure height and weight (blind gown weight)
- Check orthostatic vital signs
- Obtain oral temperature

Calculate
- Body Mass Index (BMI)
- Percent median BMI or BMI z-score

Plot Height and Weight on growth curve
- Obtain old growth curves – evaluate weight loss, change in height and weight percentiles

Perform physical exam
- Perform comprehensive exam
- Look for common physical signs of an eating disorder
## Physical Exam Findings

### Anorexia Nervosa
- Hypothermia
- Hypotension
- Bradycardia
- Dry skin
- Brittle nails
- Lanugo
- Acrocyanosis
- Lower extremity edema
- Cardiac murmur (MVP)
- Orthostatic blood pressure and pulse changes

### Bulimia Nervosa
- Callouses on back of hand (Russell’s sign)
- Salivary gland hypertrophy
- Erosion of dental enamel
- Caries
- Mouth ulcers
- Edema
- Abdominal bloating
- Cardiac arrhythmias
Laboratory Evaluation

For all patients:

- Complete blood count (CBC)
- Comprehensive metabolic panel (CMP), phosphorous, calcium, and magnesium
- Urinalysis
- Thyroid function tests (TSH, free T4)

**Plus:** For all patients consider: **Electrocardiogram (EKG)**

**Plus:** For male adolescents, formerly obese patients, and female patients with amenorrhea over 3-6 months:

**Bone densitometry (DEXA)**

**May need:** For concerns about celiac or inflammatory bowel disease:
- Erythrocyte sedimentation rate (ESR), Immune globulin A (IgA) and serum tissue transglutaminase (tTG)

**May need:** For significant or suspected self-induced emesis: Amylase and Lipase

**May need:** For amenorrhea:
- Pregnancy test (urine HCG) +/- Luteinizing hormone (LH), follicle stimulating hormone (FSH), prolactin, estradiol

Normal labs do not mean the patient is not sick.
When is a patient medically unstable?

• The medical evaluation process may reveal significant abnormal findings
• Severely abnormal findings may require medical admission for medical stabilization
  • 2003 American Academy of Pediatrics, *Medical Criteria for the Hospitalization of Children and Adolescents*
  • 2003, The Society of Adolescent Medicine, *Position Paper of the Society of Adolescent Medicine*
2003 AAP Medical Criteria for Hospitalization

Anorexia Nervosa

- Heart rate <50 beats per minute
- Systolic blood pressure <90
- Orthostatic changes in pulse (>20 beats per minute) or blood pressure (>10 mm Hg)
- Temperature <96 degrees F
- <75% ideal body weight or ongoing weight loss despite intensive outpatient therapy
- Refusal to eat
- Suicidality

Bulimia Nervosa

- Syncope
- Serum potassium < 3.2 mmol/L or serum chloride < 88 mmol/L
- Esophageal tears, hematemesis, or intractable vomiting
- Cardiac arrhythmias including prolonged QTc
- Suicidality
One or more of the following:

1. < 75% Median body mass index for age and sex
2. Dehydration
3. Electrolyte disturbance (hypokalemia, hyponatremia, hypophosphatemia)
4. EKG abnormalities
5. Physiologic instability (HR < 50 daytime, <45 night, BP<90/45, temp <96 F, orthostatic change in pulse >20 or BP>10)
6. Arrested growth and development
7. Failure of outpatient treatment
8. Acute food refusal
9. Uncontrollable bingeing and purging
10. Acute medical complications of malnutrition (i.e. seizure, syncope, cardiac failure)
11. Comorbid psychiatric or medical condition that prohibits or limits appropriate outpatient treatment (i.e. IDDM, SI, OCD)
Improving Outcomes

Three key elements that can help attain positive outcomes:

• Early detection
• Early intervention
• Restoration of body weight
  – Weight restoration facilitates the recovery process
  – Medical admission may be necessary initially

Goals of Medical Admission

Initiate correction of malnourished state - Nutrition
Evaluate psychiatric comorbidities - Psychiatry
Manage medical complications – Hospitalists/Intensivists
Develop plan of care for after hospital discharge – Case Management
Medical Complications

• In Anorexia Nervosa, the medical complications are the direct result of starvation and weight loss

• In Bulimia Nervosa, the medical complications result from the method and frequency of purging
Medical Complications of Starvation

Anorexia affects your whole body

- **Brain and Nerves**: can't think right, fear of gaining weight, sad, moody, irritable, bad memory, fainting, changes in brain chemistry
- **Hair**: hair thins and gets brittle
- **Heart**: low blood pressure, slow heart rate, fluttering of the heart (palpitations), heart failure
- **Blood**: anemia and other blood problems
- **Muscles, Joints, and Bones**: weak muscles, swollen joints, bone loss, fractures, osteoporosis
- **Kidneys**: kidney stones, kidney failure
- **Body Fluids**: low potassium, magnesium, and sodium
- **Intestines**: constipation, bloating
- **Hormones**: periods stop, problems growing, trouble getting pregnant. If pregnant, higher risk for miscarriage, having a C-section, baby with low birthweight, and post partum depression.
- **Skin**: bruise easily, dry skin, growth of fine hair all over body, get cold easily, yellow skin, nails get brittle
Complications of starvation: Cardiovascular

Severely malnourished patients lose heart mass

- Sinus bradycardia very common - associated with hypotension and hypothermia
- Waveforms normal shape on EKG
- Not an athletic heart, a starving heart
- Improves with weight restoration

At risk for sudden death

- Likely associated with low heart rate variability
- If prolonged QTc noted, look for other primary causes

At risk for congestive heart failure

- Decreased heart mass leads to decreased cardiac output
- Acute heart failure can occur with increased circulating volume – AVOID LARGE BOLUSES of fluids
- Watch for relative tachycardia during refeeding
Complications of Starvation: Gastrointestinal

Constipation
- Abnormal intestinal motility
- Treat with polyethylene glycol if needed
- Worsened by high fiber diets / Improves with smaller meals and liquid calories

Gastroparesis
- Patients have bloating, nausea, abdominal pain and early satiety
- Also improves with low fiber diet, smaller meals and liquid calories
- Some evidence for Metoclopramide 2.5 mg 30 min prior to meals

Hepatitis
- During Starvation - Resolves with continued nutritional support
  - Elevated liver function tests due to apoptosis, often associated with hypoglycemia
- During Refeeding - Resolves with decreased feeding rate
  - Elevated liver function tests due to steatohepatitis, often worse during first week of refeeding
Complications of starvation: Endocrine

Euthyroid sick syndrome

- Normal TSH, low or low normal T4 and T3, increased reverse T3
- Avoid thyroid hormone replacement

Hypoglycemia

Delays in growth and puberty

Down regulation of the HPG axis

- Females- Decreased serum estrogen levels
- Males - Decreased serum testosterone levels

Osteoporosis/osteopenia

- Usually begins early in the disease course and progresses quickly
- Patients may never reach peak bone mass
Effects on Growth


- Systemic review and meta-analysis
- 27 studies reviewed
- Growth and pubertal delay commonly reported
- Evidence for catch up growth found - however not seen in all patients and may be suboptimal
- Younger age and longer duration of illness associated with potential risk for growth delay
- Weight restoration should be encouraged to avoid adverse effects and allow an opportunity for catch up
Decreased bone accrual
  - Dysregulation of reproductive hormones
  - Impact of stress hormones
  - Decreased mechanical loading with decreased body mass
    - Weight bearing contributes to bone acquisition
Developmental trajectory of bone is disrupted
  - 40-60% of peak bone mass normally accrued during adolescence
  - 90% of peak bone mass accrued by 20 years of age
  - Adolescents with eating disorders have a 2-7x greater risk for fractures, osteopenia, and osteoporosis later in life
Bone mass increases with weight restoration and balanced nutrition
  - Treatment includes weight restoration, calcium and vitamin D supplementation
  - Estrogen replacement is neither protective nor therapeutic
Bone Loss is Not Reversible

Mumford, 2019

- Persisting negative effects on bone health despite recovery of body weight
- Reduced cortical and trabecular bone
- Reduced bone at femoral neck and arms
- Subset of patients with multiple fractures
“If adolescents are receptive to the news of a low bone mass, discussions about this health outcome could serve as a ‘wake up call’ on their road to recovery. The findings of Mumford et al. provide compelling data on the long-term skeletal implications of AN that could be cited in these conversations with patients and families. These data are another reminder of the importance of the adolescent years for bone health and beyond (i.e. peak bone mass attainment and outcomes). They are another reminder of why we want our teenagers with eating disorders to get on the road to recovery just as soon as possible.”

*Journal of Adolescent Health*, Editorial by Catherine Gordon and Amy DiVasata, 2019
• In all patients
  – Cognitive deficits
  – Wernicke encephalopathy
  – Cortical atrophy
    • Decreased volume of gray matter
    • Decreased integrity of white matter
    • Enlarged ventricles and increased CSF

- Meta-analysis of 29 studies
- In acute AN – gray matter and white matter were decreased compared to healthy controls
- Acute adolescent patients with AN - had a significantly larger grey matter reduction than adults
- Grey matter volume loss was correlated with cognitive deficits
- In adults, grey matter and white matter were improved after 1.5 to 8 years
- In adolescents, long term studies are scarce to demonstrate improvement
Other medical complications of starvation

• Hematologic
  – Leukopenia
  – Anemia
  – Thrombocytopenia
• Metabolic
  – Hypothermia
  – Hypercholesterolemia
  – Electrolyte imbalances
  – Refeeding syndrome
Refeeding Syndrome

Chronic malnutrition
Prolonged fast

↓ Insulin
↑ Glucagon
↑ Cortisol

Hypophosphataemia
Hypokalaemia
Hypomagnesaemia
Thiamine deficiency
Sodium and water retention

↑ Glucose uptake
↑ Uptake of Phosphorus,
Magnesium and Potassium
↑ Thiamine use

Convolusions, delirium,
ataxia, Wernicke's
Encephalopathy
Hypotension, Arrhythmias,
Heart Failure
Renal failure, Paralytic ileus,
Anaemia, hyperglycaemia
Peripheral oedema,
paraesthesia,
Fasciculation,
Rhabdomyolysis

Glycogenolysis
Gluconeogenesis
Protein catabolism

Depletion of electrolytes,
proteins, fats, minerals,
vitamins

↑ Proteins and glycogen
synthesis

Refueling

Insulin secretion
NICE Criteria
For determining patients at high risk for refeeding problems

Patient has **one** or more of the following:

- BMI less than 16 kg/m2
- Unintentional weight loss greater than 15% within the last 3-6 months
- Little or no nutritional intake for more than 10 days
- Low levels of potassium, phosphate or magnesium prior to refeeding

OR

Patient has **two** or more of the following:

- BMI less than 18.5 kg/m2
- Unintentional weight loss greater than 10% within the last 3-6 months
- Little or no nutritional intake for more than 5 days
- A history of alcohol abuse or drug use including insulin, diuretics, chemotherapy, or antacids

Pediatric eating disorder patients are at greater risk of developing refeeding syndrome.

Refeeding hypophosphatemia incidence rate in adolescents with anorexia nervosa is up to 38%.

Young patients often present at lower weight and lose weight faster than adults.

Level of malnutrition is significantly correlated with risk.

Malnourished adolescents who are <70% mBMI are at significantly higher risk of refeeding syndrome.
Preventing Refeeding Syndrome

Advance feeds slowly - “Start low, go slow”

Closely monitor weights and vital signs
- Daily gown weights before breakfast
- Orthostatic vital signs once or more a day
- Track I’s and O’s

Check labs frequently - Daily labs at least first week of refeeding
- Replace phosphorous before it drops
  - Treat orally with PhosNaK
  - May need to use IV phosphorous for very low levels
- Avoid calcium and vitamin d supplements while supplementing phosphorous
- May also need to replace potassium and magnesium
- Consider thiamine
Medical Complications of Purging

How bulimia affects your body

- **Blood**: anemia
- **Heart**: irregular heart beat, heart muscle weakened, heart failure, low pulse, and blood pressure
- **Body Fluids**: dehydration, low potassium, magnesium, and sodium
- **Kidneys**: problems from diuretic abuse
- **Intestines**: constipation, irregular bowel movements (BM's), bloating, diarrhea, abdominal cramping
- **Hormones**: irregular or absent period

**Brain**: depression, fear of gaining weight, anxiety, dizziness, shame, low self-esteem

**Cheeks**: swelling, soreness

**Mouth**: cavities, tooth enamel erosion, gum disease, teeth sensitive to hot and cold foods

**Throat & Esophagus**: sore, irritated, can tear and rupture, blood in vomit

**Muscles**: fatigue

**Stomach**: ulcers, pain, can rupture, delayed emptying

**Skin**: abrasion of knuckles, dry skin
Complications of purging: Gastrointestinal

Rebound constipation
- Long term laxative abuse slows colon further
- Patients at risk for cathartic colon syndrome

Esophagitis
- Risk of Barrett’s esophagus increases with chronicity
- Proton pump inhibitors are effective

Sialadenitis
- Resolves with cessation of vomiting
- Warm compresses and sialogogues may help

Dental erosion
Mallory-Weiss tears
Elevated serum amylase
Other medical complications of purging

• Metabolic
  • Metabolic alkalosis or acidosis
  • Electrolyte imbalances

• Cardiac
  • Arrhythmias
  • Chronic hypovolemia

• Endocrine
  • Irregular menses
  • Increased risk in patients with IDDM

• Renal
  • Acute kidney injury
  • Pseudo-Bartter’s syndrome
Pseudo-Bartter’s Syndrome

With bulimia patients develop chronic volume depletion

- Caused by repetitive purging (vomiting, diuretics, or insulin)
- Aldosterone increases with chronic volume depletion to prevent low blood pressure
- Increase in aldosterone leads to retention of salt and water
- Severe edema occurs with abrupt cessation of purging - Worsened by use of IVFs

Treatment consists of:

- Slowly restoring fluid volume (avoid IV boluses)
- Replace potassium and magnesium
- Use spironolactone in some cases
  - To decrease aldosterone
  - To promote potassium retention
- Keep legs elevated
- Be patient – edema will resolve in 2-3 weeks
**Hypokalemia**
- Potassium losses from vomiting, diuretic use, or laxative induced diarrhea
- Serum levels underestimate losses since potassium is an intracellular cation
- Must correct dehydration first or high aldosterone levels will cause ongoing kidney losses of potassium
- Can replace potassium orally if mild hypokalemia and mild metabolic alkalosis
- May need to give potassium in IVF if levels are less than 3 mEq/L

**Metabolic alkalosis**
- Volume contraction and high bicarbonate levels from vomiting or diuretic abuse
- Intravenous saline restores volume, decreases excess aldosterone production, and corrects alkalosis
- IVFs must be given at a slow rate (NS 50-75 cc/hr until bicarbonate <30 mEq/L)
- With bicarbonate levels over 40 mEq/L - risk increases for seizures so consider ICU
- May need to treat aldosterone over production with spironolactone - 12.5 to 25 mg daily for first 2 weeks

**Magnesium**
- Undetected magnesium deficiency will impair potassium repletion
- More common in patients with bulimia who use diuretics
Patients with eating disorders and IDDM may misuse insulin by

- Omitting doses - high blood sugar levels cause osmotic diuresis
- Increasing doses - to compensate for binges

May recognize patients because they have:

- Multiple unexplained episodes of diabetic ketoacidosis
- Higher hemoglobin A1C levels
- Repeated episodes of symptomatic hypoglycemia

Patients with IDDM and eating disorders have:

- More severe and earlier IDDM complications
  - Increased retinopathy
  - Increased nephropathy
  - Increased neuropathy
- Higher mortality rates
Inpatient hospitalization is for medical stabilization
  • Start restoration of weight
  • Normalize eating patterns
  • Correct physical and psychological complications of malnutrition

Once a patient is medically stable
  • Goal to transfer patient to a team that can provide the appropriate level of psychiatric care
  • Continue refeeding as started under expert inpatient dietetic guidance
  • Ensure that the family is supported and guided
  • Build upon gains of the inpatient team
Make sure your patient is medically stable

- Follow guidelines for medical admission
- Constantly monitor medical status

Build a multidisciplinary team

- Nutrition
- Therapy
- Psychiatry
- Medicine

Place your patient in the right level of care

- Outpatient
- Intensive Outpatient Program (IOP)
- Partial Hospitalization Program (PHP)
- Residential
- Inpatient