AMERICAN MEDICAL SOCIETY FOR SPORTS MEDICINE

Leading Sports Medicine into the Future

The 5-Minute Sports Medicine Consult

2ND EDITION

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OBESITY AND WEIGHT MANAGEMENT

David Carfagno

BASICS

DESCRIPTION

- World Health Organization definitions:
  - Overweight = body mass index (BMI) >25
  - Obesity = BMI >30
- Obesity is caused by a complex interplay between genetic and environmental factors. Ultimately, a cumulative positive energy balance causes obesity. Energy balance is determined by the difference between energy intake (calories consumed) and energy expenditure (calories expended through resting energy metabolism, the thermic effect of food, and physical activity).
- Weight gain occurs when energy intake exceeds energy expenditure (ie, positive energy balance).
- 1 lb of fat is equivalent to ~3,500 kcal of energy.

EPIDEMIOLOGY

Prevalence

- Overweight (BMI ≥25) or obesity (BMI ≥30) now affects almost 2/3 of Americans.
- The National Health and Nutrition Examination Survey, 2003–2004, showed prevalences of obesity in U.S. men and women of 31.1% and 33.2%, respectively, with particularly high rates among non-Hispanic black Americans and Mexican Americans.
- The most recent data released in November 2007 demonstrates that over the last several years there has been a plateau in the prevalence in obesity in the U.S., with over 72 million adults having a BMI >30 kg/m^2. This represents 33.3% of men and 35.3% of women.
- The WHO monitors the prevalence of obesity around the world. Although prevalence rates vary dramatically from country to country, the WHO estimates that over 1.7 billion people around the globe are overweight and 310 million are obese.
- The problem of obesity is growing in many developing countries. Rates of obesity have tripled in the last 20 yrs in the developing world, with 10% of the world's children currently overweight or obese. The Middle East, Pacific Islands, Southeast Asia, and China are facing the greatest challenges.
- The effect of obesity on mortality has shown that there is a 20–40% increase in mortality in both men and women who were overweight in midlife, and a 2–3-fold increased risk of mortality among obese individuals. This is according to the National Institutes of Health-American Association of Retired Persons (NIHAARP) cohort in 2006.
- Extremely obese people—those who are ≥80 lb over a normal weight—live 3–12 fewer yrs than their normal-weight peers. ~6% of people are extremely obese—that is, they have a BMI ≥40.
- Nonsmokers who are obese—those who are about 30 or more pounds over a healthy weight—have a shorter life span by a year or less.
- Nonsmokers who are overweight—~29 lb over a healthy weight—do not have shortened lives.
- Smoking takes a toll, too, and very heavy smokers are affected most. An 18-yr-old white male who is normal weight and does not smoke can expect to live to age 81. If he's extremely obese and a smoker, his life expectancy is 60, a difference of 21 yrs.
- The effect of extreme obesity appears to be greater for men than women and for whites than blacks.

RISK FACTORS

Genetics

- Genetic linkage to obesity comes from the data on the FTO gene (fat mass and obesity-associated) gene.
- A number of variant alleles of the FTO have been shown in several independent genome-wide association studies to be strongly and significantly associated with obesity-related traits.
- Individuals who are homozygous for the high-risk alleles weigh roughly 3 kg more than those individuals homozygous for the low-risk allele. Homozygosity appears to occur in roughly 16% of several populations that have been studied.

ETIOLOGY

- Hormones in the regulation of body weight:
  - Leptin: A hormone made in the hypothalamus, is activated when there is a decrease in appetite and when insulin is secreted. It's also made when there is an increase in the metabolic rate. Obese individuals are known to have elevated levels of leptin and become leptin-resistant.
  - Ghrelin is the key appetite hormone of the stomach. It is secreted at high levels by an empty stomach, but is decreased with feeding.
  - Other hormones involved in the regulation of appetite and satiety include adiponectin, resistin, glucagon-like peptide-1, tumor necrosis factor, plasminogen activator inhibitor type 1, and peptide YY.
- Metabolic syndrome comprises obesity, carbohydrate intolerance or type 2 diabetes, HTN, dyslipidemia, and a prothrombotic inflammatory vascular environment:
  - It is more prevalent in males over females worldwide. Male accumulation of body fat, predominantly in the trunk and visceral rather than the SC fat. It is the visceral fat that is the metabolically active fat, which produces adipokines, which increase insulin resistance.
  - Insulin resistance is closely related to the amount of visceral fat deposition and is poorly correlated with BMI.

COMMONLY ASSOCIATED CONDITIONS

- Obesity contributes to excess mortality from HTN, type 2 diabetes, coronary artery diseases, stroke, gallbladder disease, sleep apnea, and osteoarthritis.
- Cancers occurring more commonly in these individuals include endometrial, breast, prostate, colon, esophageal, and liver.
- Centripetal obesity, in which the waist-to-hip ratio is high, indicates a subset of individuals at much higher risk of cardiovascular diseases.
- Relative risk of HTN among obese adults aged 20–45 is 5–6 times that of their nonobese counterparts.
- Relative risk of diabetes and of hypercholesterolemia is increased 2.9 and 1.5 times, respectively, in obese individuals.
- Secondary causes of obesity include a number of endocrinopathies and syndromes, which result in abnormalities of systems regulating feeding behavior and/or energy expenditure:
  - Hypothyroidism
  - Hypercortisolism
  - Hypothalamic dysfunction
  - Growth hormone deficiency
  - Prader-Labhart-Willi syndrome
  - Bardet-Biedl syndrome
  - Pseudohypoparathyroidism

DIAGNOSIS

HISTORY

- Obtain weight history, diet history, eating patterns, activity history.
- Search for trigger factors, medications.

PHYSICAL EXAM

- Vital signs, including BP, heart rate, weight, height, waist circumference
- Appearance, including android or gynoid fat deposition. Android has a higher predisposition to cardiovascular disease.
- Body mass index and waist-to-hip ratio. In the office are the most reliable methods to determine body fat in the office. The gold standard test is the dual energy x-ray absorptiometry (DEXA) body composition.
- Eye exam: Fundoscopic exam to evaluate for arteriosclerosis. Visual fields to screen for homonymous hemianopsia, presence of a pituitary tumor.
- Oropharynx: Tooth enamel evaluation for chronic gastric reflux disease. Craniofacial abnormalities seen in conditions like Prader-Willi syndrome. A small posterior pharynx due to hypertrophic fat may be a clue for obstructive sleep apnea.
- Neck: Thyroid abnormalities, including asymmetrical or enlarged. Carotid bruits indicating atherosclerosis.
- Chest: Heart examination may reveal findings such as an enlarged heart, displaced PMI, S3, S4, all corresponding with cardiovascular disease and HTN. Atelectasis and bibasilar rales occur due to decreased lung compliance.
- Abdomen: Appearance of SC and visceral fat deposition. Liver may be more prominent due to fatty liver.
- Pelvis, rectal, and genitalia: Manually may be difficult to examine. Android obesity raises suspicion of testicular failure, Stein-Leventhal syndrome in women.
- Musculoskeletal: Joint arthritis may be prevalent in obese patients. Careful to evaluate every joint, especially weight-bearing joints for effusion, range of motion abnormalities.
- Skin: Maceration of the intertriginous skin folds. Acanthosis nigricans can be seen in Cushing's, polycystic ovarian syndrome, and diabetes.
- Breast: Gynecomastia in men must be differentiated from pseudogynecomastia, an increase in subareolar fat. Careful inspection in women due to larger breasts and adipose tissue.

DIAGNOSTIC TESTS & INTERPRETATION

Lab

- CBC, complete metabolic panel, including glucose, liver function tests, lipid panel, thyroid-stimulating hormone with T4, morning cortisol, urinalysis

Imaging

- DEXA scan body fat composition. The gold standard test for determining body fat.
- Other reliable tests include hydrostatic weighing, air displacement, skin calipers, body impedance.
- Chest x-ray, mammogram, colonoscopy (per routine screening guidelines, age and medically appropriate)

Diagnostic Procedures/Surgery

- Nocturnal pulse oximetry or formal sleep study
- Electrocardiogram, graded exercise treadmill Bruce ACSM protocol.
- Exercise testing may be beneficial for obese patients. When performing standard exercise testing, the level of deconditioning typically observed in this population will necessitate a low initial workload (2–3 metabolic equivalents [METS]) and small workload increments per test stage (0.5–1.0 METs).
- Other comorbidities (eg, HTN and other chronic diseases) or concerns (orthopedic limitations or elderly) may dictate modifications to the testing procedures.
- Use of leg or arm ergometry may enhance testing performance.
- Special attention to proper cuff size is necessary for accurate BP measurements.

TREATMENT

MEDICATION

- Pharmacologic therapy is appropriate for patients as an adjunct to lifestyle interventions to facilitate weight loss and prevent weight regain. Current criteria for the use of pharmacologic therapy for obesity are a BMI >30 or a BMI >27 in the presence of coexisting conditions.
- Only 4 drugs have been approved by the Food and Drug Administration for weight reduction. Phentermine and diethylpropion are adrenergic stimulants that enhance the release of norepinephrine in the brain and reduce food intake. Efficacy and safety data are limited. In randomized trials, a weight reduction was 3–4% greater in the medication groups than in the placebo. The drugs are classified by the Drug Enforcement Agency as Schedule IV controlled substances. Limited data suggest that these stimulants may be effective for more than 10 yrs, but they have been approved only for short-term use.
- Sibutramine is a serotonin-norepinephrine reuptake inhibitor that reduces appetite. In several randomized trials, weight loss was 5% greater for subjects taking sibutramine than for those taking placebo. The combination of a group taking sibutramine and lifestyle modification resulted in weight loss at 12 mos of 12.1 kg than did the sibutramine group alone (5 kg) or lifestyle intervention alone (6.7 kg). Common side effects include HTN and tachycardia.
- Orlistat is a triacylglycerol lipase inhibitor that reduces fat absorption by about 30%. One study showed that in combination with lifestyle changes, orlistat reduced body weight by 3% more than intervention alone. Common side effects include fecal incontinence, oily stools, and flatus. It's now available OTC.

ADDITIONAL TREATMENT

Referral

Ancillary services may be needed for a multidisciplinary approach, including psychotherapists, registered dietician, exercise physiologist, physical therapy. Referral at times necessary for morbidly obese to bariatric surgery consult.

SURGERY/OTHER PROCEDURES

- Bariatric surgical treatments reduce calorie intake by restrictive or malabsorptive operations on the GI tract.
- The 2 main procedures are the Roux-en-Y bypass and the laparoscopic adjustable gastric banding.
- The National Institutes of Health guidelines for adults recommended consideration of bariatric surgery with BMI at least 40 kg/m^2 or a BMI at least 35 kg/m^2 with significant obesity-related comorbidities.
- Bariatric surgery in adults improved diabetes (77% of patients), hyperlipidemia (83%), HTN (66%), and sleep apnea (88%).
- Adverse effects include perioperative complications, dehydration, bowel obstruction, anastomotic leaks, ulcers, cholelithiasis, and vitamin deficiencies.
- Mortality rates are reported as 0.5% for bypass, 0.1% for gastric banding, and 1.1% for malabsorptive procedures.

ONGOING CARE

DIET

The U.S. Department of Agriculture puts out the Dietary Guidelines for Americans every 5 yrs, last published in 2005. For long-term weight maintenance, individuals should follow these dietary guidelines:

- Diet rich in fruits and vegetables. Intake a variety from all 5 vegetable subgroups (dark green, orange, legumes, starchy vegetables, and other vegetables) several times a week.
- Consume ~3-oz servings of whole-grain products daily, and >50% of grain products consumed should come from whole grains.
- Goal of a fiber intake of 25–30 g/day. Will contribute to increased satiety, reduced hunger, and improved weight loss.
- Limit total fat intake to 20–35% of daily calories, with most fats coming from polyunsaturated or monounsaturated sources.

PATIENT EDUCATION

- Exercise prescription is based on working on the model of frequency, intensity, duration with goal in mind to encourage greater overall energy expenditure within the program for the obese individual.
- Primary mode should be large muscle group aerobic activities.
- The initial exercise training intensity should be moderate (eg, 40–60% VO_2R or HRR) with more emphasis placed on increased duration and frequency. Eventual progression to higher exercise intensities (50–75% VO_2R or HRR) allows for further increases in VO_2max, which in turn allows for a more efficient exercise session.
- Frequency of training: 5–7 d/w
- Duration of training session: 45–60 min
- Volume of training: Initial training volume should focus on attainment of 150 min of moderate intensity exercise weekly. However, the optimal maintenance dose of physical activity is >2,000 kcal/w.
- Special considerations: Obese individuals are at an increased risk for orthopedic injury, and this may require that the intensity of exercise be maintained at or below the intensity recommended for improvement of fitness. Nonweight-bearing activities may be necessary. Obese individuals are at an increased risk of hyperthermia during exercise. Equipment modifications may be needed (ie, wide seats on cycle ergometers and rowers).
- In 2007, the CDC published Evidence-Based Recommendations for Promoting Physical Activity:
  - Creating information approaches: Large-scale, visible campaigns via television, radio, newspaper, etc.
  - Point of decision prompts: Signs in elevators to promote stair usage
  - Behavioral and social approaches: Teach behavioral skills to help incorporate physical activity into daily routines.
  - Environmental and policy approaches: Social networks of exercise groups
- Future directions of obesity research lie in the field of genetics and of responsiveness to lifestyle and pharmacologic interventions.
- Since identification of the leptin gene, new hormones and metabolic pathways involved in the regulation of body weight have been discovered (eg, ghrelin). This may lead to the development of new classes of drugs that can alter/modify energy balance.

ADDITIONAL READING

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CODES

ICD9

- 278.00 Obesity, unspecified
- 278.01 Morbid obesity
- 278.02 Overweight