Evaluation and Management of Obesity: Introduction

Over 66% of U.S. adults are currently categorized as overweight or obese, and the prevalence of obesity is increasing rapidly throughout most of the industrialized world. Based on statistics from the World Health Organization, overweight and obesity may soon replace more traditional public health concerns such as undernutrition and infectious diseases as the most significant contributors to ill health. Children and adolescents are also becoming more obese, indicating that the current trends will accelerate over time. Obesity is associated with an increased risk of multiple health problems, including hypertension, type 2 diabetes, dyslipidemia, degenerative joint disease, and some malignancies. Thus, it is important for physicians to routinely identify, evaluate, and treat patients for obesity and associated comorbid conditions.

Evaluation

The U.S. Preventive Services Task Force recommends that physicians screen all adult patients for obesity and offer intensive counseling and behavioral interventions to promote sustained weight loss. This recommendation is consistent with previously released guidelines from the National Heart, Lung, and Blood Institute (NHLBI) and a number of medical societies. The five main steps in the evaluation of obesity are described below and include (1) focused obesity-related history, (2) physical examination to determine the degree and type of obesity, (3) comorbid conditions, (4) fitness level, and (5) the patient's readiness to adopt lifestyle changes.

THE OBESITY-FOCUSED HISTORY

Information from the history should address the following six questions:

- What factors contribute to the patient's obesity?
- How is the obesity affecting the patient's health?
- What is the patient's level of risk from obesity?
- What are the patient's goals and expectations?
- Is the patient motivated to begin a weight management program?
- What kind of help does the patient need?

Although the vast majority of obesity can be attributed to behavioral features that affect diet and physical activity patterns, the history may suggest secondary causes that merit further evaluation. Disorders to consider include polycystic ovarian syndrome, hypothyroidism, Cushing's syndrome, and hypothalamic disease. Drug-induced weight gain should also to be considered. Common causes include antidiabetes agents (insulin, sulfonylureas, thiazolidinediones); steroid hormones; psychotropic agents; mood stabilizers (lithium); antidepressants (tricyclics, monoamine oxidase inhibitors, paraxetine, mirtazapine); and antiepileptic drugs (valproate, gabapentin, carbamazapine). Other medications such as nonsteroidal anti-inflammatory drugs and calcium-channel blockers may cause peripheral edema, but they do not increase body fat.

The patient's current diet and physical activity patterns may reveal factors that contribute to the development of obesity in addition to identifying behaviors to target for treatment. This type of historical information is best obtained by using a questionnaire in combination with an interview.

BMI AND WAIST CIRCUMFERENCE

Three key anthropometric measurements are important to evaluate the degree of obesity—weight, height, and waist circumference. The body mass index (BMI), calculated as weight (kg)/height $(m)^2$, or as weight (lbs)/height $(inches)^2$ x 703, is used to classify weight status and risk of disease (Tables 75-1 and 75-2). BMI is used since it provides an estimate of body fat and is related to risk of disease. Lower BMI thresholds for overweight and obesity have been proposed for the Asia-Pacific region since this population appears to be at-risk at lower body weights for glucose and lipid abnormalities.

Table 75-1 Body Mass Index (BMI) Table

BMI	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Height, inches	**Body Weight, pounds**																
58	91	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167
59	94	99	104	109	114	119	124	128	133	138	143	148	153	158	163	168	173
60	97	102	107	112	118	123	128	133	138	143	148	153	158	163	168	174	179

BMI	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Height, inches	**Body Weight, pounds**																
61	100	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185
62	104	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191
63	107	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197
64	110	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204
65	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210
66	118	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216
67	121	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223
68	125	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230
69	128	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236
70	132	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243
71	136	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	250
72	140	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258
73	144	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265
74	148	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272
75	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	279
76	156	164	172	180	189	197	205	213	221	230	238	246	254	263	271	279	287

BMI	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
58	172	177	181	186	191	196	201	205	210	215	220	224	229	234	239	244	248	253	258
59	178	183	188	193	198	203	208	212	217	222	227	232	237	242	247	252	257	262	267
60	184	189	194	199	204	209	215	220	225	230	235	240	245	250	255	261	266	271	276
61	190	195	201	206	211	217	222	227	232	238	243	248	254	259	264	269	275	280	285
62	196	202	207	213	218	224	229	235	240	246	251	256	262	267	273	278	284	289	295
63	203	208	214	220	225	231	237	242	248	254	259	265	270	278	282	287	293	299	304
64	209	215	221	227	232	238	244	250	256	262	267	273	279	285	291	296	302	308	314
65	216	222	228	234	240	246	252	258	264	270	276	282	288	294	300	306	312	318	324
66	223	229	235	241	247	253	260	266	272	278	284	291	297	303	309	315	322	328	334
67	230	236	242	249	255	261	268	274	280	287	293	299	306	312	319	325	331	338	344
68	236	243	249	256	262	269	276	282	289	295	302	308	315	322	328	335	341	348	354
69	243	250	257	263	270	277	284	291	297	304	311	318	324	331	338	345	351	358	365
70	250	257	264	271	278	285	292	299	306	313	320	327	334	341	348	355	362	369	376
71	257	265	272	279	286	293	301	308	315	322	329	338	343	351	358	365	372	379	386
72	265	272	279	287	294	302	309	316	324	331	338	346	353	361	368	375	383	390	397
73	272	280	288	295	302	310	318	325	333	340	348	355	363	371	378	386	393	401	408
74	280	287	295	303	311	319	326	334	342	350	358	365	373	381	389	396	404	412	420
75	287	295	303	311	319	327	335	343	351	359	367	375	383	391	399	407	415	423	431
76	295	304	312	320	328	336	344	353	361	369	377	385	394	402	410	418	426	435	443

Table 75-2 Classification of Weight Status and Risk of Disease

	BMI (kg/m^2)	Obesity Class	Risk of Disease
Underweight	<18.5		
Healthy weight	18.5–24.9		
Overweight	25.0–29.9		Increased
Obesity	30.0–34.9	I	High
Obesity	35.0–39.9	II	Very high
Extreme Obesity	≥40	III	Extremely high

Source: Adapted from National Institutes of Health, National Heart, Lung, and Blood Institute: *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults*. U.S. Department of Health and Human Services, Public Health Service, 1998.

Excess abdominal fat, assessed by measurement of waist circumference or waist-to-hip ratio, is independently associated with higher risk for diabetes mellitus and cardiovascular disease. Measurement of the waist circumference is a surrogate for visceral adipose tissue and should be performed in the horizontal plane above the iliac crest. Cut points that define higher risk for men and women based on ethnicity have been proposed by the International Diabetes Federation (Table 75-3).

Table 75-3 Ethnic-Specific Values for Waist Circumference

Ethnic Group	Waist Circumference
Europeans	
Men	>94 cm (37 in)
Women	>80 cm (31.5 in)
South Asians and Chinese	
Men	>90 cm (35 in)
Women	>80 cm (31.5 in)
Japanese	
Men	>85 cm (33.5 in)
Women	>90 cm (35 in)
Ethnic south and central Americans	Use south Asian recommendations until more specific data are available.
Sub-Saharan Africans	Use European data until more specific data are available.
Eastern Mediterranean and Middle East (Arab) populations	Use European data until more specific data are available.

Source: From KGMM Alberti et al for the IDF Epidemiology Task Force Consensus Group: The metabolic syndrome—a new worldwide definition. Lancet 366:1059, 2005.

PHYSICAL FITNESS

Several prospective studies have demonstrated that physical fitness, reported by questionnaire or measured by a maximal treadmill exercise test, is an important predictor of all-cause mortality independent of BMI and body composition. These observations highlight the importance of taking an exercise history during examination as well as emphasizing physical activity as a treatment approach.

OBESITY-ASSOCIATED COMORBID CONDITIONS

The evaluation of comorbid conditions should be based on presentation of symptoms, risk factors, and index of suspicion. All patients should have a fasting lipid panel (total, LDL, and HDL cholesterol and triglyceride levels) and blood glucose measured at presentation along with blood pressure determination. Symptoms and diseases that are directly or indirectly related to obesity are listed in Table 75-4. Although individuals vary, the number and severity of organ-specific comorbid conditions usually rise with increasing levels of obesity. Patients at very high absolute risk include the following: established coronary heart disease; presence of other atherosclerotic diseases such as peripheral arterial disease, abdominal aortic aneurysm, and symptomatic carotid artery disease; type 2 diabetes; and sleep apnea.

Table 75-4 Obesity-Related Organ Systems Review

Cardiovascular	**Respiratory**
Hypertension	Dyspnea
Congestive heart failure	Obstructive sleep apnea
Cor pulmonale	Hypoventilation syndrome
Varicose veins	Pickwickian syndrome
Pulmonary embolism	Asthma
Coronary artery disease	**Gastrointestinal**
Endocrine	Gastroesophageal reflux disease
Metabolic syndrome	Nonalcoholic fatty liver disease
Type 2 diabetes	Cholelithiasis
Dyslipidemia	Hernias

Polycystic ovarian syndrome	Colon cancer
Musculoskeletal	**Genitourinary**
Hyperuricemia and gout	Urinary stress incontinence
Immobility	Obesity-related glomerulopathy
Osteoarthritis (knees and hips)	Hypogonadism (male)
Low back pain	Breast and uterine cancer
Carpal tunnel syndrome	Pregnancy complications
Psychological	**Neurologic**
Depression/low self-esteem	Stroke
Body image disturbance	Idiopathicintracranial hypertension
Social stigmatization	Meralgia paresthetica
Integument	Dementia
Striae distensae	
Stasis pigmentation of legs	
Lymphedema	
Cellulitis	
Intertrigo, carbuncles	
Acanthosis nigricans	
Acrochordon (skin tags)	
Hidradenitis suppurativa	

ASSESSING THE PATIENT'S READINESS TO CHANGE

An attempt to initiate lifestyle changes when the patient is not ready usually leads to frustration and may hamper future weight-loss efforts. Assessment includes patient motivation and support, stressful life events, psychiatric status, time availability and constraints, and appropriateness of goals and expectations. Readiness can be viewed as the balance of two opposing forces: (1) motivation, or the patient's desire to change; and (2) resistance, or the patient's resistance to change.

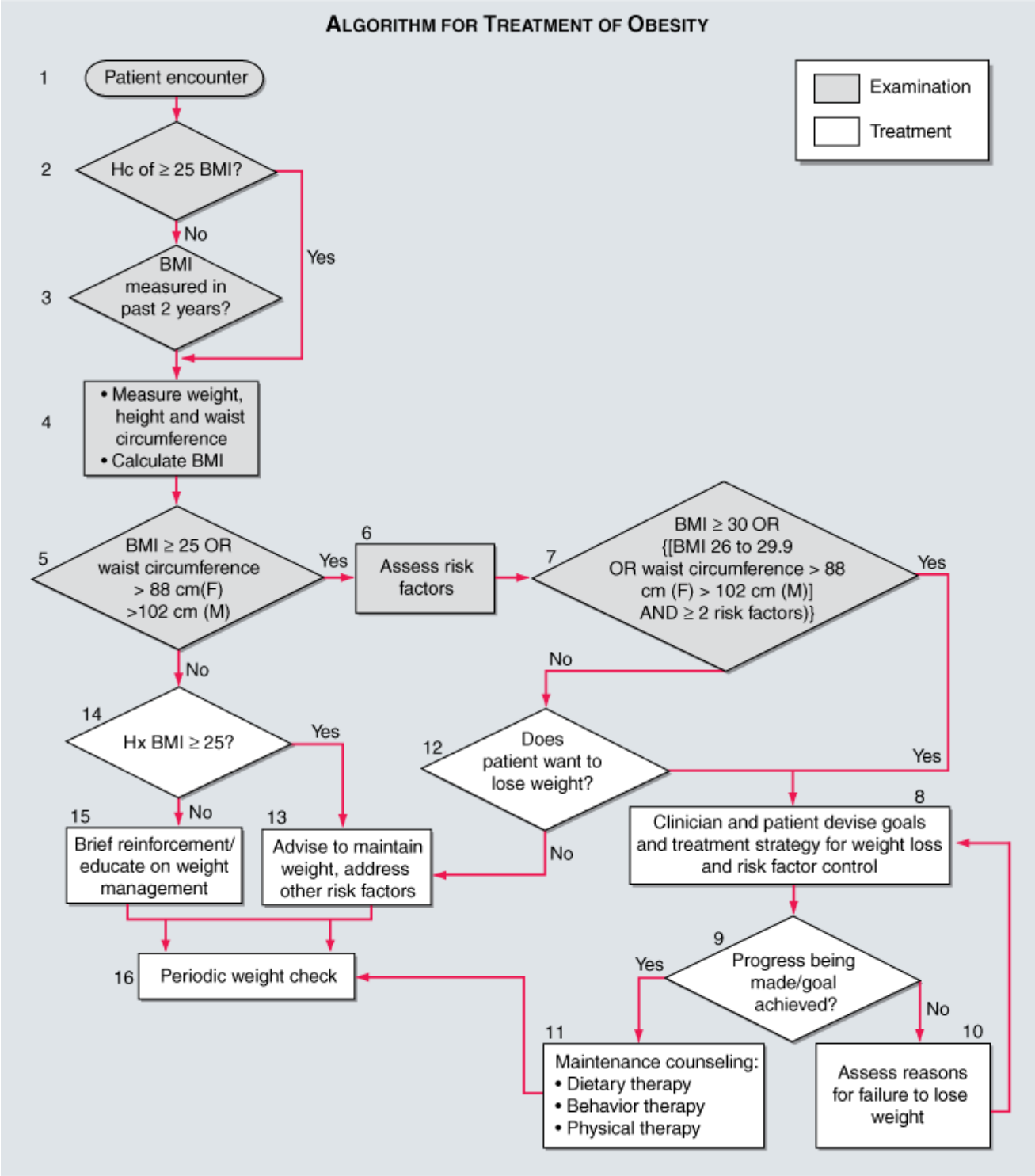
A helpful method to begin a readiness assessment is to "anchor" the patient's interest and confidence to change on a numerical scale. Using this technique, the patient is asked to rate his or her level of interest and confidence on a scale from 0 to 10, with 0 being not so important (or confident) and 10 being very important (or confident) to lose weight at this time. This exercise helps to establish readiness to change and also serves as a basis for further dialogue.

Obesity: Treatment

THE GOAL OF THERAPY

The primary goal of treatment is to improve obesity-related comorbid conditions and reduce the risk of developing future comorbidities. Information obtained from the history, physical examination, and diagnostic tests is used to determine risk and develop a treatment plan (Fig. 75-1). The decision of how aggressively to treat the patient, and which modalities to use, is determined by the patient's risk status, expectations, and available resources. Therapy for obesity always begins with lifestyle management and may include pharmacotherapy or surgery, depending on BMI risk category (Table 75-5). Setting an initial weight-loss goal of 10% over 6 months is a realistic target.

Figure 75-1



Source: Fauci AS, Kasper DL, Braunwald E, Hauser SL, Longo DL, Jameson JL, Loscalzo J: *Harrison's Principles of Internal Medicine*, 17th Edition: http://www.accessmedicine.com

Treatment algorithm. This algorithm applies only to the assessment for overweight and obesity and subsequent decisions on that assessment. It does not reflect any initial overall assessment for other conditions that the physician may wish to perform. Ht, height; Hx, history; Wt, weight. *(From National, Heart, Lung, and Blood Institute: Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: The evidence report. Washington, DC, US Department of Health and Human Services, 1998.)*

Table 75-5 A Guide to Selecting Treatment

	BMI Category				
Treatment	**25–26.9**	**27–29.9**	**30–35**	**35–39.9**	**≥40**
Diet, exercise, behavior therapy	With comorbidities	With comorbidities	+	+	+
Pharmacotherapy		With comorbidities	+	+	+

	BMI Category				
Treatment	**25–26.9**	**27–29.9**	**30–35**	**35–39.9**	**≥40**
Surgery				With comorbidities	+

Source: From National Heart, Lung, and Blood Institute, North American Association for the Study of Obesity (2000).

LIFESTYLE MANAGEMENT

Obesity care involves attention to three essential elements of lifestyle: dietary habits, physical activity, and behavior modification. Because obesity is fundamentally a disease of energy imbalance, all patients must learn how and when energy is consumed (diet), how and when energy is expended (physical activity), and how to incorporate this information into their daily life (behavior therapy). Lifestyle management has been shown to result in a modest (typically 3–5 kg) weight loss compared to no treatment or usual care.

Diet Therapy

The primary focus of diet therapy is to reduce overall calorie consumption. The NHLBI guidelines recommend initiating treatment with a calorie deficit of 500–1000 kcal/d compared to the patient's habitual diet. This reduction is consistent with a goal of losing approximately 1–2 lb per week. This calorie deficit can be accomplished by suggesting substitutions or alternatives to the diet. Examples include choosing smaller portion sizes, eating more fruits and vegetables, consuming more whole-grain cereals, selecting leaner cuts of meat and skimmed dairy products, reducing fried foods and other added fats and oils, and drinking water instead of caloric beverages. It is important that the dietary counseling remains patient-centered and that the goals are practical, realistic, and achievable.

The macronutrient composition of the diet will vary depending on the patient's preference and medical condition. The 2005 U.S. Department of Agriculture Dietary Guidelines for Americans (Chap. 70), which focus on health promotion and risk reduction, can be applied to treatment of the overweight or obese patient. The recommendations include maintaining a diet rich in whole grains, fruits, vegetables, and dietary fiber; consuming two servings (8 oz) of fish high in omega 3 fatty acids per week; decreasing sodium to <2300 mg/d; consuming 3 cups of milk (or equivalent low-fat or fat-free dairy products) per day; limiting cholesterol to <300 mg/d; and keeping total fat between 20 and 35% of daily calories and saturated fats to <10% of daily calories. Application of these guidelines to specific calorie goals can be found on the websitewww.mypyramid.gov. The revised Dietary Reference Intakes for Macronutrients released by the Institute of Medicine recommends 45–65% of calories from carbohydrates, 20–35% from fat, and 10–35% from protein. The guidelines also recommend daily fiber intake of 38 g (men) and 25 g (women) for persons over 50 years of age and 30 g (men) and 21 g (women) for those under 50.

Since portion control is one of the most difficult strategies for patients to manage, the use of pre-prepared products, such as meal replacements, is a simple and convenient suggestion. Examples include frozen entrees, canned beverages and bars. Use of meal replacements in the diet has been shown to result in a 7–8% weight loss.

A current area of controversy is the use of low-carbohydrate, high-protein diets for weight loss. These diets are based on the concept that carbohydrates are the primary cause of obesity and lead to insulin resistance. Most low-carbohydrate diets (e.g., South Beach, Zone, and Sugar Busters!) recommend a carbohydrate level of approximately 40–46% of energy. The Atkins diet contains 5–15% carbohydrate, depending on the phase of the diet. Several randomized, controlled trials of these low-carbohydrate diets have demonstrated greater weight loss at 6 months with improvement in coronary heart disease risk factors, including an increase in HDL cholesterol and a decrease in triglyceride levels. Weight loss between groups did not remain statistically significant at 1 year; however, low-carbohydrate diets appear to be at least as effective as low-fat diets in inducing weight loss for up to 1 year.

Another dietary approach to consider is the concept of energy density, which refers to the number of calories (energy) a food contains per unit of weight. People tend to ingest a constant volume of food, regardless of caloric or macronutrient content. Adding water or fiber to a food decreases its energy density by increasing weight without affecting caloric content. Examples of foods with low-energy density include soups, fruits, vegetables, oatmeal, and lean meats. Dry foods and high-fat foods such as pretzels, cheese, egg yolks, potato chips, and red meat have a high-energy density. Diets containing low-energy dense foods have been shown to control hunger and result in decreased caloric intake and weight loss.

Occasionally, very-low-calorie diets (VLCDs) are prescribed as a form of aggressive dietary therapy. The primary purpose of a VLCD is to promote a rapid and significant (13–23 kg) short-term weight loss over a 3–6 month period. These propriety formulas typically supply ≤800 kcal, 50–80 g protein, and 100% of the recommended daily intake for vitamins and minerals. According to a review by the National Task Force on the Prevention and Treatment of Obesity, indications for initiating a VLCD include well-motivated individuals who are moderately to severely obese (BMI >30), have failed at more conservative approaches to weight loss, and have a medical condition that would be immediately improved with rapid weight loss. These conditions include poorly controlled type 2 diabetes, hypertriglyceridemia, obstructive sleep apnea, and symptomatic peripheral edema. The risk for gallstone formation increases exponentially at rates of weight loss >1.5 kg/week (3.3 lb/week). Prophylaxis against gallstone formation with ursodeoxycholic acid, 600 mg/d, is effective in reducing this risk. Because of the need for close metabolic monitoring, these diets are usually prescribed by physicians specializing in obesity care.

Physical Activity Therapy

Although exercise alone is only moderately effective for weight loss, the combination of dietary modification and exercise is the most effective behavioral approach for the treatment of obesity. The most important role of exercise appears to be in the maintenance of the weight loss. Currently, the *minimum* public health recommendation for physical activity is 30 min of moderate intensity physical activity on most, and preferably all, days of the week. Focusing on simple ways to add physical activity into the normal daily routine through leisure activities, travel, and domestic work should be suggested. Examples include walking, using the stairs, doing home and yard work, and engaging in sport activities. Asking the patient to wear a pedometer to monitor total accumulation of steps as part of the activities of daily living is a useful strategy. Step counts are highly correlated with activity level. Studies have demonstrated that lifestyle activities are as effective as structured exercise programs for improving cardiorespiratory fitness and weight loss. The Dietary Guidelines for Americans 2005 summarizes compelling evidence that at least 60–90 min of daily moderate-intensity physical activity (420–630 min per week) is needed to sustain weight loss (http://www.health.gov/dietaryguidelines/dga2005/). The American College of Sports Medicine recommends that overweight and obese individuals progressively increase to a minimum of 150 min of moderate intensity physical activity per week as a first goal. However, for long-term weight loss, a higher level of exercise (e.g., 200–300 min or ≥2000 kcal per week) is needed. These recommendations are daunting to most patients and need to be implemented gradually. Consultation with an exercise physiologist or personal trainer may be helpful.

Behavioral Therapy

Cognitive behavioral therapy is used to help change and reinforce new dietary and physical activity behaviors. Strategies include self-monitoring techniques (e.g., journaling, weighing, and measuring food and activity); stress management; stimulus control (e.g., using smaller plates, not eating in front of the television or in the car); social support; problem solving; and cognitive restructuring to help patients develop more positive and realistic thoughts about themselves. When recommending any behavioral lifestyle change, have the patient identify what, when, where, and how the behavioral change will be performed. The patient should keep a record of the anticipated behavioral change so that progress can be reviewed at the next office visit. Because these techniques are time-consuming to implement, they are often provided by ancillary office staff such as a nurse clinician or registered dietitian.

PHARMACOTHERAPY

Adjuvant pharmacologic treatments should be considered for patients with a BMI >30 kg/m^2 or with a BMI >27 kg/m^2 who also have concomitant obesity-related diseases and for whom dietary and physical activity therapy has not been successful. When prescribing an antiobesity medication, patients should be actively engaged in a lifestyle program that provides the strategies and skills needed to effectively use the drug since this support increases total weight loss.

There are several potential targets of pharmacologic therapy for obesity. The most thoroughly explored treatment is suppression of appetite via centrally active medications that alter monoamine neurotransmitters. A second strategy is to reduce the absorption of selective macronutrients from the gastrointestinal (GI) tract, such as fat. These two mechanisms form the basis for all currently prescribed antiobesity agents. A third target, selective blocking of the endocannabinoid system, has recently been identified.

Centrally Acting Anorexiant Medications

Appetite-suppressing drugs, or anorexiants, affect satiety—the absence of hunger after eating—and hunger—a biologic sensation that initiates eating. By increasing satiety and decreasing hunger, these agents help patients reduce caloric intake without a sense of deprivation. The target site for the actions of anorexiants is the ventromedial and lateral hypothalamic regions in the central nervous system (Chap. 74). Their biological effect on appetite regulation is produced by augmenting the neurotransmission of three monoamines: norepinephrine; serotonin [5-hydroxytryptamine (5-HT)]; and, to a lesser degree, dopamine. The classic sympathomimetic adrenergic agents (benzphetamine, phendimetrazine, diethylpropion, mazindol, and phentermine) function by stimulating norepinephrine release or by blocking its reuptake. In contrast, sibutramine (Meridia) functions as a serotonin and norepinephrine reuptake inhibitor. Unlike other previously used anorexiants, sibutramine is not pharmacologically related to amphetamine and has no addictive potential.

Sibutramine is the only anorexiant that is currently approved by the Food and Drug Administration (FDA) for long-term use. It produces an average loss of about 5–9% of initial body weight at 12 months. Sibutramine has been demonstrated to maintain weight loss for up to 2 years. The most commonly reported adverse events of sibutramine are headache, dry mouth, insomnia, and constipation. These are generally mild and well-tolerated. The principal concern is a dose-related increase in blood pressure and heart rate that may require discontinuation of the medication. A dose of 10–15 mg/d causes an average increase in systolic and diastolic blood pressure of 2–4 mmHg and an increase in heart rate of 4–6 beats/min. For this reason, all patients should be monitored closely and evaluated within 1 month after initiating therapy. The risk of adverse effects on blood pressure are no greater in patients with controlled hypertension than in those who do not have hypertension, and the drug does not appear to cause cardiac valve dysfunction. Contraindications to sibutramine use include uncontrolled hypertension, congestive heart failure, symptomatic coronary heart disease, arrhythmias, or history of stroke. Similar to other antiobesity medications, weight reduction is enhanced when the drug is used along with behavioral therapy, and body weight increases when the medication is discontinued.

Peripherally Acting Medications

Orlistat (Xenical) is a synthetic hydrogenated derivative of a naturally occurring lipase inhibitor, lipostatin, produced by the mold *Streptomyces toxytricini*. Orlistat is a potent, slowly reversible inhibitor of pancreatic, gastric, and carboxylester lipases and phospholipase A2, which are required for the hydrolysis of dietary fat into fatty acids and monoacylglycerols. The drug acts in the lumen of the stomach and small intestine by forming a covalent bond with the active site of these lipases. Taken at a therapeutic dose of 120 mg tid, orlistat blocks the digestion and absorption of about 30% of dietary fat. After discontinuation of the drug, fecal fat usually returns to normal concentrations within 48–72 h.

Multiple randomized, 1–2 year double-blind, placebo-controlled studies have shown that after one year, orlistat produces a weight loss of about 9–10%, compared with a 4–6% weight loss in the placebo-treated groups. Because orlistat is minimally (<1%) absorbed from the GI tract, it has no systemic side effects. Tolerability to the drug is related to the malabsorption of dietary fat and subsequent passage of fat in the feces. GI tract adverse effects are reported in at least 10% of orlistat-treated patients. These include flatus with discharge, fecal urgency, fatty/oily stool, and increased defecation. These side effects are generally experienced early, diminish as patients control their dietary fat intake, and infrequently cause patients to withdraw from clinical trials. Psyllium mucilloid is helpful in controlling the orlistat-induced GI side effects when taken concomitantly with the medication. Serum concentrations of the fat-soluble vitamins D and E and β–carotene may be reduced, and vitamin supplements are recommended to prevent potential deficiencies. Orlistat was approved for other-the-counter use in 2007.

The Endocannabinoid System

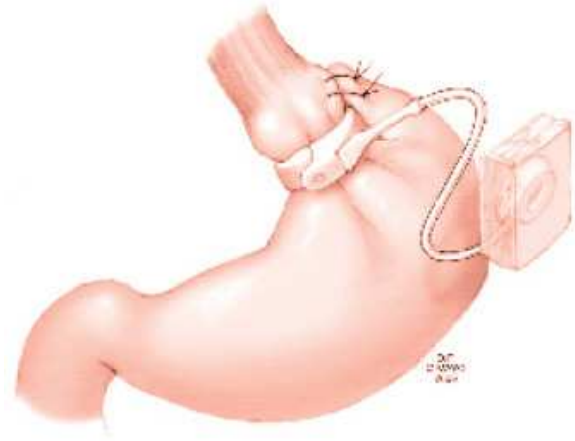
Cannabinoid receptors and their endogenous ligands have been implicated in a variety of physiologic functions, including feeding, modulation of pain, emotional behavior, and peripheral lipid metabolism. Cannabis and its main ingredient, Δ^9-tetrahydrocannabinol (THC), is an exogenous cannabinoid compound. Two endocannabinoids have been identified, anandamide and 2-arachidonyl glyceride. Two cannabinoid receptors have been identified: CB_1 (abundant in the brain) and CB_2 (present in immune cells). The brain endocannabinoid system is thought to control food intake through reinforcing motivation to find and consume foods with high incentive value and to regulate actions of other mediators of appetite. The first selective cannabinoid CB_1 receptor antagonist, rimonabant, was discovered in 1994. The medication antagonizes the orexigenic effect of THC and suppresses appetite when given alone in animal models. Several large prospective, randomized controlled trials have demonstrated the effectiveness of rimonabant as a weight-loss agent. Taken as a 20 mg dose, subjects lost an average of 6.5 kg (14.32 lb) compared to 1.5 kg (3.3 lb) for placebo at 1 year. Concomitant improvements were seen in waist circumference and cardiovascular risk factors. The most common reported side effects include depression, anxiety, and nausea. FDA approval of Rimonabant is still pending.

SURGERY

Bariatric surgery can be considered for patients with severe obesity (BMI ≥40 kg/m^2) or those with moderate obesity (BMI ≥35 kg/m^2) associated with a serious medical condition. Surgical weight loss functions by reducing caloric intake and, depending on the procedure, macronutrient absorption.

Weight-loss surgeries fall into one of two categories: restrictive and restrictive-malabsorptive (Fig. 75-2). Restrictive surgeries limit the amount of food the stomach can hold and slow the rate of gastric emptying. The vertical banded gastroplasty (VBG) is the prototype of this category but is currently performed on a very limited basis due to lack of effectiveness in long-term trials. Laparoscopic adjustable silicone gastric banding (LASGB) has replaced the VBG as the most commonly performed restrictive operation. The first banding device, the lap-band, was approved for use in the United States in 2001. In contrast to previous devices, the diameter of this band is adjustable by way of its connection to a reservoir that is implanted under the skin. Injection or removal of saline into the reservoir tightens or loosens the band's internal diameter, thus changing the size of the gastric opening.

Figure 75-2



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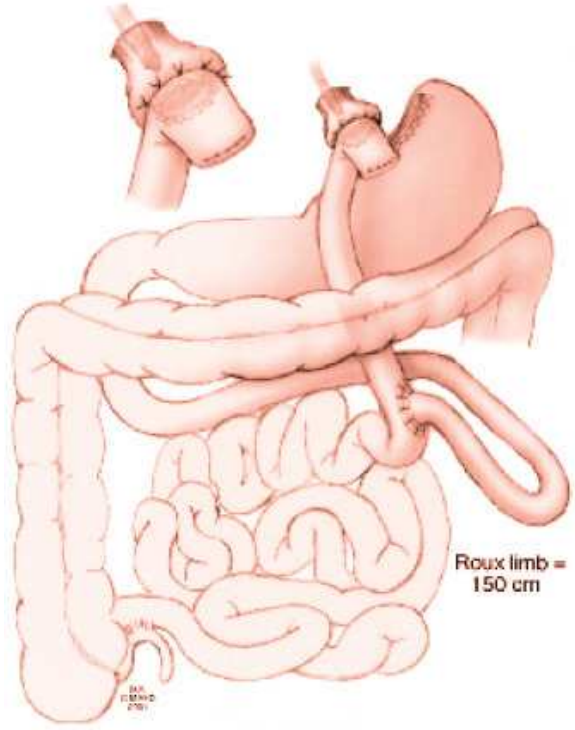

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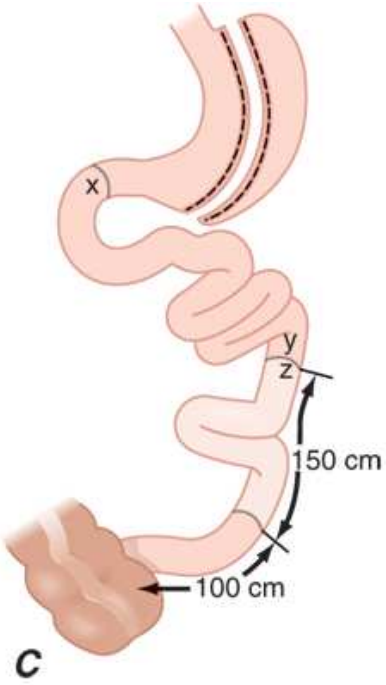

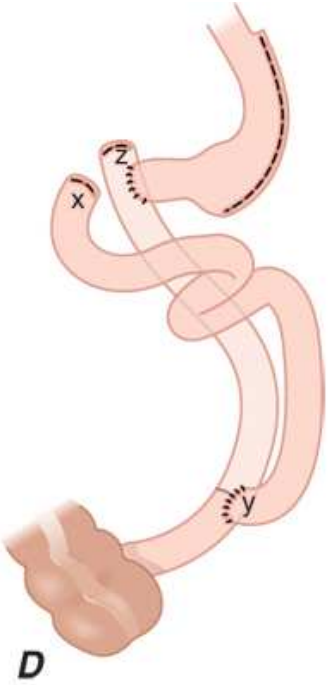

Bariatric surgical procedures. Examples of operative interventions used for surgical manipulation of the gastrointestinal tract. ***A.*** Laparoscopic gastric band (LAGB). ***B.*** The Roux-en-Y gastric bypass. ***C.*** Biliopancreatic diversion with duodenal switch. ***D.*** Biliopancreatic diversion. *(From ML Kendrick, GF Dakin. Surgical approaches to obesity. Mayo Clin Proc 815:518, 2006; with permission.)*

The three restrictive-malabsorptive bypass procedures combine the elements of gastric restriction and selective malabsorption. These procedures include Roux-en-Y gastric bypass (RYGB), biliopancreatic diversion (BPD), and biliopancreatic diversion with duodenal switch (BPDDS) (Fig. 75-2). RYGB is the most commonly performed and accepted bypass procedure. It may be performed with an open incision or laparoscopically.

Although no recent randomized controlled trials compare weight loss after surgical and nonsurgical interventions, data from meta-analyses and large databases, primarily obtained from observational studies, suggest that bariatric surgery is the most effective weight-loss therapy for those with clinically severe obesity. These procedures generally produce a 30–35% average

total body weight loss that is maintained in nearly 60% of patients at 5 years. In general, mean weight loss is greater after the combined restrictive-malabsorptive procedures compared to the restrictive procedures. An abundance of data supports the positive impact of bariatric surgery on obesity-related morbid conditions, including diabetes mellitus, hypertension, obstructive sleep apnea, dyslipidemia, and nonalcoholic fatty liver disease.

Surgical mortality from bariatric surgery is generally <1% but varies with the procedure, patient's age and comorbid conditions, and experience of the surgical team. The most common surgical complications include stomal stenosis or marginal ulcers (occurring in 5–15% of patients) that present as prolonged nausea and vomiting after eating or inability to advance the diet to solid foods. These complications are typically treated by endoscopic balloon dilatation and acid suppression therapy, respectively. For patients who undergo LASGB, there are no intestinal absorptive abnormalities other than mechanical reduction in gastric size and outflow. Therefore, selective deficiencies occur uncommonly unless eating habits become unbalanced. In contrast, the restrictive-malabsorptive procedures increase risk for micronutrient deficiencies of vitamin B_{12}, iron, folate, calcium, and vitamin D. Patients with restrictive-malabsorptive procedures require lifelong supplementation with these micronutrients.

Further Readings

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