Cardiovascular disease is a collective term used to refer to disorders of the circulatory system (e.g., heart, arteries, veins) of the body. Cardiovascular disease affects approximately 65 million Americans at an annual cost of about $368 billion. Medical history has subdivided these diseases into the areas or organs of the body in which the pathology is most obvious, such as coronary artery disease (CAD) (see Chapter 22) pertaining to narrowing or obstruction of the arteries of the heart leading to angina pectoris (see Chapter 25) and myocardial infarction (MI). Stroke (see Chapter 27) refers to either an obstruction or rupture of blood vessels in the brain. An increase in the pressure with which blood circulates through the arteries and veins is referred to as hypertension (see Chapter 23). Dysrhythmias (see Chapter 24) refer to abnormalities in the electrical conduction pathways of the heart that lead to inefficient pumping of blood through the circulatory system. Peripheral vascular disease refers to disorders of the blood vessels of the arms and legs. Peripheral vascular disease can be subdivided into two types based on arterial or venous origin: peripheral arterial disease (see Chapter 26) such as obstructive arterial disease, and venous disorders, such as acute deep vein thrombosis (see Chapter 27). The long-term pathology of any one or a combination of these diseases affecting the circulatory system leads to heart failure (see Chapter 28) and eventual death.

METABOLIC SYNDROME

There are many causes that lead to cardiovascular disorders (Box 21-1). Lifestyle is recognized as possibly the greatest contributor to a variety of diseases that reduce the quality of life and end lives prematurely. These diseases also cost the American economy billions upon billions of dollars that could be used in many more positive ways to benefit mankind. Although investigators have hypothesized about various factors that lead to cardiovascular disease since the 1920s, 1960s research indicated that persons with hypertension, diabetes mellitus, dyslipidemia, and obesity, alone or in combination, were found to be at greater risk for progressive cardiovascular disease. In
From Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults: *People with central obesity and at least two of the remaining four factors are considered to have metabolic syndrome.

¶Or previously diagnosed type 2 diabetes.

§Specific circumferences for different ethnicities.

Health.

Education Program (NCEP), of Overweight and Obesity in Adults” describes

...ries. The 1998 National Heart, Lung, and Blood Institute/National Institutes of Health.

...rdemic, low high-density lipoproteins (HDLs), and hypertension. Although metabolic syndrome is a worldwide disease, an estimated 47 million adults (1 in 5) in the United States have metabolic syndrome. More than 4% of adolescents ages 12 through 19 also have metabolic syndrome. Within ethnic groups, African American males have the lowest rate at 14%, whereas Mexican-American women have the highest rate at 27%. Table 21-1 shows a comparison of criteria from the United States–based National Cholesterol Education Program (NCEP) and the International Diabetes Federation (IDF). People with central obesity and two of the four other criteria are defined as having metabolic syndrome.

Risk factors for the development of metabolic syndrome include poor diet, sedentary lifestyle (lack of exercise), and genetic predisposition. As a society “on the go,” our dietary habits have changed significantly over the past 20 years, causing a dramatic increase in weight gain in the United States. Simply put, weight gain occurs when energy intake (food calories) exceeds energy expenditure (burning calories). The 1998 National Heart, Lung, and Blood Institute (NHLBI) expert report titled “Clinical Guidelines on the Identification, Evaluation and Treatment of Overweight and Obesity in Adults” describes weight in proportion to height as body mass index (BMI). It is measured by:

weight in kilograms

\[
\frac{\text{weight in pounds} \times 703}{(\text{height in inches})^2}
\]

The NHLBI guidelines also describe overweight and obesity in terms of the BMI. See Table 21-2 for the definitions of healthy weight, overweight, and obesity. In 1991, four states had obesity prevalence rates of 15% to 19% and no states had rates at or above 20%. In 2003, 15 states had prevalence rates of 15% to 19%; 31 states had rates of 20% to 24%; and 4 states had rates more than 25% (Figure 21-1) (CDC, 2004). A sedentary lifestyle also contributes to overweight and obesity. New technologies ranging from labor-saving devices to remote control devices to the availability of entertainment though television and computers have significantly reduced daily caloric expenditure. Today, despite common knowledge that regular exercise is healthy, more than 60% of Americans are not regularly physically active, and 25% are not active at all. Increased working hours that lead to less time to prepare food at home and larger portions of commercially prepared food aggravate the problem. Ease and convenience of food preparation (e.g., fast-food restaurants, drive-throughs;

**Table 21-1** Definitions and Characteristics of Metabolic Syndrome*

<table>
<thead>
<tr>
<th>Risk factor defining limit</th>
<th>NATIONAL CHEOLESTEROL EDUCATION PROGRAM† (NCEP) (USA)</th>
<th>INTERNATIONAL DIABETES FEDERATION‡ (IDF) (INTERNATIONAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MEN</td>
<td>WOMEN</td>
</tr>
<tr>
<td>Waist circumference (inches)</td>
<td>&gt;40</td>
<td>&gt;36</td>
</tr>
<tr>
<td>HDL cholesterol (mg/dL)</td>
<td>&lt;40</td>
<td>&lt;50</td>
</tr>
<tr>
<td>Triglycerides (mg/dL)</td>
<td>&gt;150</td>
<td>&gt;150</td>
</tr>
<tr>
<td>Blood pressure (mm Hg)</td>
<td>&gt;130/85</td>
<td>&gt;130/85</td>
</tr>
<tr>
<td>Fasting glucose (mg/dL)</td>
<td>&gt;110</td>
<td>&gt;110</td>
</tr>
</tbody>
</table>

*People with central obesity and at least two of the remaining four factors are considered to have metabolic syndrome.


‡From International Diabetes Federation: The IDF Consensus Worldwide Definition of the Metabolic Syndrome

§Specific circumferences for different ethnicities.

¶Or specific treatment for this abnormality.

¶Or previously diagnosed type 2 diabetes.

**Table 21-2** Relationship between Body Mass Index and Categories of Obesity

<table>
<thead>
<tr>
<th>BODY MASS INDEX (BMI) (kg/m²)</th>
<th>RELATIONSHIP WITH WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;18.5</td>
<td>Underweight</td>
</tr>
<tr>
<td>18.5-24.9</td>
<td>Normal weight</td>
</tr>
<tr>
<td>25-29.9</td>
<td>Overweight</td>
</tr>
<tr>
<td>30-34.9</td>
<td>Obesity, class I</td>
</tr>
<tr>
<td>35-39.9</td>
<td>Obesity, class II</td>
</tr>
<tr>
<td>&gt;40</td>
<td>Obesity, class III (extreme obesity)</td>
</tr>
</tbody>
</table>
use of a microwave versus a convection oven), and increases in portion sizes ("supersize it, please!") have placed too many easily consumed calories on the table of the American public. Consequently, reduced physical activity and increased caloric intake have resulted in a national epidemic of obesity. Other negative lifestyle choices such as excessive consumption of alcohol and smoking aggravate metabolic syndrome. Excessive alcohol consumption causes fat accumulation in the liver, which is also associated with metabolic syndrome. Smoking is a major contributor to both pulmonary disease (see Chapter 31) and hypertension (see Chapter 23).

Genetic factors influence each component of the syndrome as well as the syndrome itself. A family history of first-degree relatives (e.g., parents, siblings) that includes type 2 diabetes, hypertension, and early heart disease (e.g., angina, "heart attack") greatly increases the likelihood that an individual will develop metabolic syndrome (Figure 21-2).

In addition to type 2 diabetes and heart disease, other consequences associated with metabolic syndrome include renal disease, obstructive sleep apnea, polycystic ovary syndrome, cognitive decline in the elderly, and dementia in the elderly.

**Treatment of Metabolic Syndrome**

The variety of factors associated with the presence of metabolic syndrome requires that an individualized approach to treatment is necessary based on a person’s specific risk factors and diseases present. Lifestyle management is critical in preventing and treating the comorbidities that make up the metabolic syndrome. Research indicates that lifestyle changes alone may delay the onset of type 2 diabetes mellitus by more than 50%. The overall treatment goals for metabolic syndrome are listed in Box 21-2.

Weight loss and increased physical activity are usually the first steps to treatment. Reducing the number of calories consumed, while at the same time burning more calories, can have very positive effects in reducing metabolic syndrome. Even a 10- to 15-pound weight loss can improve hypertension and hyperglycemia. Initial therapeutics goals are a 7% to 10% weight reduction in the first year of treatment, with an ongoing goal of a body index of less than 25 kg/m². Several dietary approaches can be used to lose weight. Adopting the Dietary Approaches to Stop Hypertension (DASH) diet may be helpful for patients who also have hypertension (see Chapter 23). The Mediterranean diet, one that is rich in "good" fats (e.g., olive oil) and contains a reasonable amount of carbohydrates and proteins from fish and chicken is frequently recommended. Diet should reduce intake of saturated fat (<7% of total calories), *trans* fat, cholesterol levels (<200 mg/day), and total fat (25% to 35% of total calories). Most dietary fat should be unsaturated, and simple sugars should be reduced. Nonpharmacologic therapy must include elimination of smoking, restriction of alcohol intake, stress reduction, and sodium control (see Chapter 23).
and very active). The report also illustrates how difficult levels of physical activity (sedentary, low active, active, based on height, weight, and gender for four different daily maximum caloric intake of food to be consumed normal levels. The report makes recommendations about muscle and less fat, blood glucose levels tend to return to normalization site for glucose, and as exercise leads to more burn calories. Muscles are the primary storage and utilization site for glucose, and as exercise leads to more calibration required. It recommends 60 minutes of moderate-intensity physical activity (e.g., walking at a rate of 4 to 5 miles per hour), or high-intensity activity (e.g., jogging at a rate of 4 to 5 miles in 20 to 30 minutes) four to seven times weekly, in addition to the activities of daily living, to maintain body weight (in adults) in the recommended body mass index range (18 to 25 kg/m²). The exercise does not have to be completed at the same time, but can be worked into a person’s daily activities.

If after lifestyle modifications and diet and exercise the patient is not able to meet the therapeutic goals in treating metabolic syndrome, then drug therapy may be necessary. Patient education is vitally important in making patients aware of and treating metabolic syndrome. This education should be emphasized and reiterated frequently by the physician, pharmacist, and nurse.

**Drug Therapy for Metabolic Syndrome**

Drug therapy must be individualized for each patient’s underlying diseases.

**Hypertension**

A combination of a thiazide diuretic plus an angiotensin-converting enzyme inhibitor or a beta blocker will be necessary. Other combinations of therapy may be used depending on the person’s race and the presence of other diseases. (See Chapter 23 for a discussion of the treatment of hypertension.)

**Dyslipidemia**

The treatment of dyslipidemia is generally to lower the triglycerides and LDL cholesterol and raise the HDL cholesterol. After lifestyle changes, medicines most commonly used are the 3-hydroxy-methylglutaryl coenzyme A reductase inhibitors (also known as statins), fibric acid derivatives, and niacin. (See Chapter 22 for a discussion of the treatment of dyslipidemias.)

**Type 2 Diabetes Mellitus**

Several different classes of medicines may be used to treat insulin resistance and type 2 diabetes. The thiazolidinediones reduce insulin resistance in peripheral tissues; metformin decreases production of glucose by the liver, and to a lesser extent, reduces insulin resistance in peripheral tissues; alpha-glycosidase inhibitors reduce the absorption of glucose from the intestine, reducing postprandial hyperglycemia; and sulfonylureas and meglitinides stimulate the beta cells of the pancreas to release more insulin. Insulin injections also benefit patients who do not secrete adequate amounts of insulin. (See Chapter 36 for a discussion of the treatment of type 2 diabetes mellitus.)
**NURSING PROCESS for Metabolic Syndrome**

See the nursing process for each of the primary cardiovascular diseases:
- Dyslipidemias, Chapter 22, p. ***
- Hypertension, Chapter 23, p. ***
- Dysrhythmias, Chapter 24, p. ***
- Angina Pectoris, Chapter 25, p. ***
- Peripheral Vascular Disease, Chapter 26, p. ***
- Thromboembolic Disorders, Chapter 27, p. ***
- Heart Failure, Chapter 28, p. ***

**Key Points**

- Cardiovascular diseases are a major cause of premature death in the United States.
- More than 20% of the U.S. adult population has metabolic syndrome, and is at much greater risk for cardiovascular diseases. The key characteristics of metabolic syndrome (also known as insulin resistance syndrome and syndrome X) are type 2 diabetes mellitus, abdominal obesity, hypertriglyceridemia, low HDL cholesterol, and hypertension.
- The most cost-effective and successful forms of treatment are smoking cessation, weight reduction, exercise, stress reduction, and dietary modification. If change in diet and exercise do not produce an acceptable decrease in blood lipid levels, blood glucose levels, and hypertension, antilipemic agents, antihyperglycemic agents, and antihypertensive agents may be added to the patient’s regimen.

**MATH REVIEW QUESTIONS**

1. Order: Lipitor 20-mg tab
   Available: Atorvastatin 10-mg tablets
   Give _____ tablets.

2. Order: Mevacor 10-mg tab daily
   Available: Lovastatin 20-mg tab
   Give _____ tablets.

3. Order: Nicardipine 1 mg IV stat
   Available: Nicardipine 2.5 mg/mL
   Give _____ mL.

4. Order: Verapamil 5 mg IV
   Available: Verapamil 2.5 mg/mL
   Give _____ mL.

**CRITICAL THINKING QUESTIONS**

1. Develop a teaching plan for the patient who is at risk for metabolic syndrome. Be specific with your interventions. Include the following topics: smoking reduction, exercise, proper diet, and stress reduction.

2. List the key characteristics of metabolic syndrome and the role they play in development.

3. Explain how the BMI is figured.

**CONTENT REVIEW QUESTIONS**

1. Which of the following would be an acceptable BMI?
   1. 20.3
   2. 17.5
   3. 26
   4. 35

2. Which of the following is not used as an evaluation tool for metabolic syndrome?
   1. Blood pressure
   2. Lipid profile
   3. Blood glucose
   4. Liver enzymes

3. Recommendations about daily maximum caloric intake of food to be consumed should be based on which of the following? *(Select all that apply.)*
   1. Height and weight
   2. Gender
   3. Race
   4. Levels of physical activity

4. If lifestyle changes are not effective for metabolic syndrome, the client may need drug therapy. Select all of the following drugs that may be used in treating metabolic syndrome.
   1. Thiazide diuretics
   2. Beta blockers
   3. Statins
   4. Analgesics