

aortic valve disease, and hypertrophic cardiomyopathy may cause or contribute to angina and should be excluded or treated. Obesity, hypertension, and hyperthyroidism should be treated aggressively to reduce the frequency and severity of anginal episodes. Decreased myocardial oxygen supply may be due to reduced oxygenation of the arterial blood (e.g., in pulmonary disease or, when carboxyhemoglobin is present, due to cigarette or cigar smoking) or decreased oxygen-carrying capacity (e.g., in anemia). Correction of these abnormalities, if present, may reduce or even eliminate angina pectoris.

ADAPTATION OF ACTIVITY

Myocardial ischemia is caused by a discrepancy between the demand of the heart muscle for oxygen and the ability of the coronary circulation to meet that demand. Most patients can be helped to understand this concept and utilize it in the rational programming of activity. Many tasks that ordinarily evoke angina may be accomplished without symptoms simply by reducing the speed at which they are performed. Patients must appreciate the diurnal variation in their tolerance of certain activities and should reduce their energy requirements in the morning, immediately after meals, and in cold or inclement weather. On occasion, it may be necessary to recommend a change in employment or residence to avoid physical stress.

Physical conditioning usually improves the exercise tolerance of patients with angina and has substantial psychological benefits. A regular program of isotonic exercise that is within the limits of the individual patient's threshold for the development of angina pectoris and that does not exceed 80% of the heart rate associated with ischemia on exercise testing should be strongly encouraged. Based on the results of an exercise test, the number of metabolic equivalent tasks (METs) performed at the onset of ischemia can be estimated (Table 293-2) and a practical exercise prescription can be formulated to permit daily activities that will fall below the ischemic threshold (Table 293-3).

TREATMENT OF RISK FACTORS

A *family history* of premature IHD is an important indicator of increased risk and should trigger a search for treatable risk factors such as hyperlipidemia, hypertension, and diabetes mellitus. *Obesity* impairs the treatment of other risk factors and increases the risk of adverse coronary events. In addition, obesity often is accompanied by three other risk factors: diabetes mellitus, hypertension, and hyperlipidemia. The treatment of obesity and these accompanying risk factors is an important component of any management plan. A diet low in saturated and *trans*-unsaturated fatty acids and a reduced caloric intake to achieve optimal body weight are a cornerstone in the management of chronic IHD. It is especially important to emphasize weight loss and regular exercise in patients with the metabolic syndrome or overt diabetes mellitus.

Cigarette smoking accelerates coronary atherosclerosis in both sexes and at all ages and increases the risk of thrombosis, plaque instability, myocardial infarction, and death (Chap. 291e). In addition, by increasing myocardial oxygen needs and reducing oxygen supply, it aggravates angina. Smoking cessation studies have demonstrated important benefits with a significant decline in the occurrence of these adverse outcomes. The physician's message must be clear and strong and supported by programs that achieve and monitor abstinence (Chap. 470). *Hypertension* (Chap. 298) is associated with an increased risk of adverse clinical events from coronary atherosclerosis as well as stroke. In addition, the left ventricular hypertrophy that results from sustained hypertension aggravates ischemia. There is evidence that long-term effective treatment of hypertension can decrease the occurrence of adverse coronary events.

Diabetes mellitus (Chap. 417) accelerates coronary and peripheral atherosclerosis and is frequently associated with dyslipidemias and increases in the risk of angina, myocardial infarction, and sudden coronary death. Aggressive control of the dyslipidemia (target LDL cholesterol <70 mg/dL) and hypertension (target blood pressure 120/80 mmHg) that are frequently found in diabetic patients is highly effective and therefore essential, as described below.

TABLE 293-3 ENERGY REQUIREMENTS FOR SOME COMMON ACTIVITIES

| Less Than 3 METs | 3–5 METs | 5–7 METs | 7–9 METs | More Than 9 METs |
|------------------------------|----------------------------------|-----------------------------|-----------------------------------|--|
| Self-Care | | | | |
| Washing/shaving | Cleaning windows | Easy digging in garden | Heavy shoveling | Carrying loads up stairs (objects more than 90 lb) |
| Dressing | Raking | Level hand lawn mowing | Carrying objects (60–90 lb) | Climbing stairs (quickly) |
| Light housekeeping | Power lawn mowing | Carrying objects (30–60 lb) | | Shoveling heavy snow |
| Desk work | Bed making/stripping | | | |
| Driving auto | Carrying objects (15–30 lb) | | | |
| Occupational | | | | |
| Sitting (clerical/assembly) | Stocking shelves (light objects) | Carpentry (exterior) | Digging ditches (pick and shovel) | Heavy labor |
| Desk work | Light welding/carpentry | Shoveling dirt | | |
| Standing (store clerk) | | Sawing wood | | |
| Recreational | | | | |
| Golf (cart) | Dancing (social) | Tennis (singles) | Canoeing | Squash |
| Knitting | Golf (walking) | Snow skiing (downhill) | Mountain climbing | Ski touring |
| | Sailing | Light backpacking | | Vigorous basketball |
| | Tennis (doubles) | Basketball | | |
| | | Stream fishing | | |
| Physical Conditioning | | | | |
| Walking (2 mph) | Level walking (3–4 mph) | Level walking (4.5–5.0 mph) | Level jogging (5 mph) | Running more than 6 mph |
| Stationary bike | Level biking (6–8 mph) | Bicycling (9–10 mph) | Swimming (crawl stroke) | Bicycling (more than 13 mph) |
| Very light calisthenics | Light calisthenics | Swimming, breast stroke | Rowing machine | Rope jumping |
| | | | Heavy calisthenics | Walking uphill (5 mph) |
| | | | Bicycling (12 mph) | |

Abbreviation: METs, metabolic equivalent tasks.

Source: Modified from WL Haskell: Rehabilitation of the coronary patient, in NK Wenger, HK Hellerstein (eds): *Design and Implementation of Cardiac Conditioning Program*. New York, Churchill Livingstone, 1978.