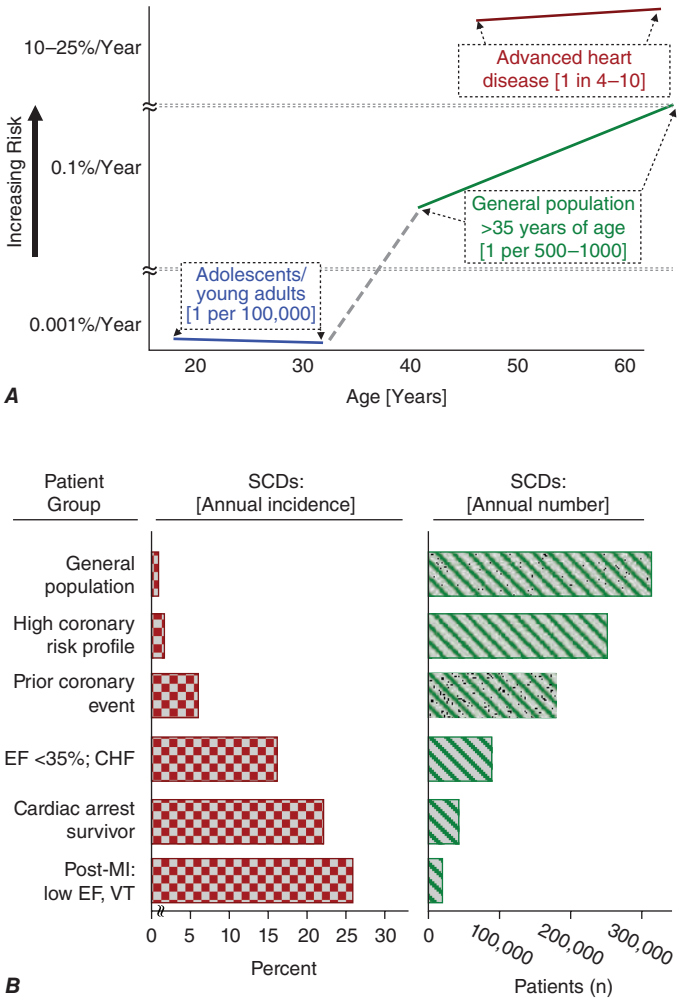

FIGURE 327-1 ***Panel A*** demonstrates age-related risk for sudden cardiac death (SCD). For the general population age 35 years and older, SCD risk is 0.1–0.2% per year (1 per 500–1000 population). Among the general population of adolescents and adults younger than age 30 years, the overall risk of SCD is 1 per 100,000 population, or 0.001% per year. The risk of SCD increases dramatically beyond age 35 years. The greatest rate of increase is between 40 and 65 years (vertical axis is discontinuous). Among patients older than 30 years of age, with advanced structural heart disease and markers of high risk for cardiac arrest, the event rate may exceed 25% per year, and age-related risk attenuates. *(Modified from RJ Myerburg, A Castellanos: Cardiac arrest and sudden cardiac death, in P Libby et al [eds]: Braunwald's Heart Disease, 8th ed. Philadelphia, Saunders, 2008.)* ***Panel B*** demonstrates the incidence of SCD in population subgroups and the relation of total number of events per year to incidence figures. Approximations of subgroup incidence figures and the related population pool from which they are derived are presented. Approximately 50% of all cardiac deaths are sudden and unexpected. The incidence bars on the left (percent/year) indicate the approximate percentage of sudden and nonsudden deaths in each of the population subgroups indicated, ranging from the lowest percentage in unselected adult populations (0.1–2% per year) to the highest percentage in patients with severe left ventricular dysfunction and heart failure (approximately 25% per year). The bars on the right indicate the total number of events per year in each of these groups with the population impact size of each of the subgroups. The highest risk categories identify the smallest number of total annual events, and the lowest incidence category accounts for the largest number of events per year. CHF, congestive heart failure; EF, ejection fraction; MI, myocardial infarction; VT, ventricular tachycardia. *(After RJ Myerburg et al: Circulation 85:2, 1992.)*

PATHOLOGY

Data from postmortem examinations of SCD victims parallel the clinical observations on the prevalence of CHD as the major structural etiologic factor. More than 80% of SCD victims have pathologic findings of CHD. The pathologic description often includes a combination of long-standing, extensive atherosclerosis of the epicardial coronary arteries and unstable coronary artery lesions, which include various permutations of eroded, fissured, or ruptured plaques; platelet aggregates; hemorrhage; and/or thrombosis. As many as 70–75% of males who die suddenly have preexisting healed MIs, whereas only 20–30% have recent acute MIs, despite the prevalence of unstable plaques and thrombi. The latter suggests transient ischemia as the mechanism of onset. Regional or global left ventricular (LV) hypertrophy often coexists with prior MIs.

PREDICTION AND PREVENTION OF CARDIAC ARREST AND SUDDEN CARDIAC DEATH

SCD accounts for approximately one-half the total number of cardiovascular deaths. As shown in Fig. 327-1*B*, the very-high-risk subgroups consist of more focused populations at higher risk of cardiac arrest or SCD, with better individual prediction, but the representation of such subgroups within the overall population burden of SCD is small. This is indicated by the absolute number of events ("events per year"), in contrast to the percentage per year in the subgroup. To achieve a major population impact, effective prevention of underlying diseases and the development of new epidemiologic and clinical probes that will allow better individual risk prediction by identifying specific high-risk subgroups within the large general populations are needed.

Strategies for predicting and preventing SCD are classified as primary and secondary. *Primary prevention* refers to the attempt to identify individual patients at specific risk for SCD and institute preventive strategies. *Secondary prevention* refers to measures taken to prevent recurrent cardiac arrest or death in individuals who have survived a prior cardiac arrest.

The effectiveness of the prevention strategies currently used depends on the magnitude of risk among the various population subgroups. Because the annual incidence of SCD among the unselected adult population is limited to approximately 1 per 1000 population per year (Fig. 327-1) and ~50% of all SCDs due to coronary artery disease occur as the first clinical manifestation of the disease (Fig. 327-2*A*), the only currently practical strategies are profiling for risk of developing CHD and risk factor control (Fig. 327-2*B*). The most powerful long-term risk factors include age, cigarette smoking, elevated serum cholesterol, diabetes mellitus, elevated blood pressure, LV hypertrophy, and nonspecific electrocardiographic abnormalities. Markers of inflammation (e.g., levels of C-reactive protein) that may predict plaque destabilization have been added to risk classifications. The presence of multiple risk factors progressively increases incidence, but not sufficiently or specifically enough to warrant therapies targeted to potentially fatal arrhythmias (Fig. 327-1*A*). However, recent studies suggesting familial clustering of SCD associated with a first acute coronary syndrome offer hope that genetic markers for specific risk may be forthcoming.

After coronary artery disease has been identified in a patient, additional strategies for risk profiling become available (Fig. 327-2*B*), but the majority of SCDs occur among the large unselected groups rather than in the specific high-risk subgroups that become evident among populations with established disease (compare events per year with percentage per year in Fig. 327-1*B*). After a major cardiovascular event, such as acute MI, recent onset of heart failure, or survival after out-of-hospital cardiac arrest, the highest risk of death occurs during the initial 6–18 months after the event and then plateaus toward the baseline risk associated with the extent of underlying disease. However, many of the early deaths are nonsudden, diluting the potential benefit of strategies targeted specifically to SCD. Thus, although post-MI beta blocker therapy has an identifiable benefit for both early SCD and nonsudden mortality risk, a total mortality benefit for implantable cardioverter-defibrillator (ICD) therapy early after MI has not been observed.