Atherosclerosis and the Biobehavioral Sciences

Last year, the Working Group on Arteriosclerosis of the National Heart, Lung, and Blood Institute comprehensively reviewed progress in research on arteriosclerosis. Since 1968, the United States has experienced a steady decline in the death rate from cardiovascular diseases, and the rate of decline has been especially rapid in the past 10 years. Even so, in 1978, the most recent year for which data are available, arteriosclerotic-related diseases accounted for nearly 900,000 deaths, about 640,000 of which were from coronary heart disease. That year, arteriosclerosis had an estimated economic impact of $37 billion — 14% of the total costs of all diseases. Such compelling figures highlight the need for vigorous basic and applied research on arteriosclerosis.

Prospective epidemiological studies begun in the late 1950s identified certain individual conditions or behaviors as risk factors for cardiovascular disease. Established, independent risk factors include hypertension, hypercholesterolemia, and cigarette smoking. The Working Group on Arteriosclerosis noted that efforts to learn how such risk factors contribute to cardiovascular disease already have helped to uncover basic mechanisms of arteriosclerosis; questions about their effects continue to lead researchers into fundamental and applied research in such diverse areas as cell membrane physiology, clotting mechanisms, lipoprotein chemistry, hemodynamics, and genetics.

Epidemiologic studies also have shown that individual behavioral traits and social environmental conditions can be risk factors for cardiovascular disease. The association between Type A behavior and cardiovascular disease has been increasingly documented in recent years. Type A behavior adds to the risk of cardiovascular disease independently of and by the same magnitude as other risk factors such as hypertension, age, hypercholesterolemia, and smoking. In addition, community disintegration and lack of social supports appear to be risk factors. For example, Japanese migrants to Hawaii and California are at increased risk of cardiovascular disease, compared to Japanese in Japan, possibly as a result of weakened social ties. There is evidence that the high level of social support in traditional Japanese culture protects against coronary heart disease, even after controlling for differences in age, serum cholesterol, diet, blood pressure, and cigarette smoking. In an analogous study of a close Italian community in Pennsylvania, an unusually low incidence of cardiovascular disease changed to a higher level when strong community supports were lost. The effects of social supports are probably important over a wide range of cultures. For example, in a random sample of 7000 California adults followed for 9 years, people who lacked social ties were more likely to die of coronary heart disease than were those with such ties, independent of other known risk factors. Thus, experimental analysis of social and behavioral factors in atherosclerosis is highly desirable.

In this issue Kaplan et al. report on their study of the effects on coronary arteries of a social condition — group stability — and of a behavioral trait — dominance — in cynomolgus monkeys on an atherogenic diet. Dominant monkeys in unstable groups developed much more severe atherosclerosis than did dominant monkeys in stable groups or subordinate animals in either group. The observed differences were not due to changes in total serum cholesterol, high density lipoprotein cholesterol, blood pressure, obesity, or fasting blood glucose. This animal model makes the important point that a behavioral trait may be pathogenic only under specific circumstances. Unstable group membership disrupted affiliative interactions and intensified agonistic encounters for the dominant members, which may have contributed to the pathogenic interaction between group instability and individual dominance.
The physiological mechanism for the observed increase in atherosclerosis remains to be established. In a potentially related animal model, Nerem, et al. found that rabbits on an atherogenic diet who were tamed and handled daily had 60% less atherosclerotic plaque formation than did rabbits receiving routine animal room care. In both cases, it seems likely that some aspect of the stress response is involved. In this regard, a clinical study by Glass, et al. is interesting. Plasma epinephrine secretion was measured in Type A and Type B subjects during competition with or without concomitant harassment. During straight competition, the two groups showed similar responses; harassment produced a marked increase in epinephrine secretion for Type A but not for Type B subjects. At present, little is known about the effects of repeated physiological surges of epinephrine and other stress-responsive hormones, including the endorphins. However, such changes may link behavioral risk factors and disease.

Clarification of the mechanisms underlying the results reported by Kaplan, et al. will require a combination of approaches that properly fall within the domain of the biobehavioral sciences, as do studies of the behavioral and neurophysiological aspects of other risk factors such as hypertension and smoking. Recently, the Institute of Medicine of the National Academy of Sciences published reports from two major studies that considered potential roles of the biobehavioral sciences in clarifying and ameliorating such problems. The first of these, Stress and Human Health, examined the current state of stress research and identified promising lines of inquiry. The second, Health and Behavior, broadly reviewed the existing and potential role of the biobehavioral sciences in reducing the current burden of illness.

Together, the two Institute of Medicine projects reflect the informed assessments of over 400 leaders in the biomedical and behavioral sciences. Their strong consensus was that the scientific study of behavior is flourishing, with major advances in basic knowledge about the brain and behavior. New techniques for studying brain function and behavior offer a promise of deeper understanding. In the cardiovascular field, much could be gained if some excellent biomedical scientists would expand their interests to include behavioral problems and if behavioral scientists would pay greater attention to atherosclerosis. Such shifts of attention of even a few outstanding scientists could greatly facilitate progress toward constructing a unified biobehavioral science pertinent to health and disease.

References

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