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Editor

John H. K. Vogel, Santa Barbara, Calif.

Fifth Conference on Cardiovascular Disease
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Introduction

This is the fifth cardiovascular conference to be held at Snowmass-at-Aspen, the purpose of which was to evaluate the current status of aggressive surgical medical care in acute coronary artery disease and to attempt to establish guidelines for the management of impending infarction, infarction and cardiogenic shock. The current status of pharmacologic therapy, emergency coronary artery bypass surgery, myocardial resection and assisted circulation, used as a combined effort with additional facilities in the cardiac care unit, is emphasized. In view of the rapidly changing indications for an aggressive approach in acute coronary artery disease, the integration of medical surgical care as outlined above needs to be constantly re-evaluated.

The help and advice of Dr. BRUCE PATON, Dr. JAMES H. GAULT, Dr. JAMES S. FORRESTER and Dr. BRUCE MCFADDEN in developing this conference is gratefully acknowledged. I am particularly indebted to Miss KYM WESTENBERG for her help in the preparation and arrangement of this conference, as well as in editing the manuscripts; to Miss JEAN ROBINSON for assistance in co-ordinating this conference, and to Miss MARY ANNE MCINERNEY and Dr. WILLIAM LIKOFF of the American College of Cardiology who helped make this meeting possible.

Appreciation is expressed to General Electric Medical Systems Department (Milwaukee, Wisconsin), Surgitool Inc. (Pittsburgh Pennsylvania) and Travenol Laboratories Inc. (Morton Grove, Illinois) for educational grants which supported in part this program.

JOHN H. K. VOGEL, M.D.

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Sudden Death

Risk Factor Analysis

Coronary artery disease is the most common cause of sudden death in the United States. It is characterized by atherosclerosis of the coronary arteries, which can lead to a heart attack (myocardial infarction) or a sudden cardiac death (SCD). SCD is a sudden, unexpected death of a person with no obvious structural heart disease. It is often caused by a sudden increase in heart rate, which can lead to a fatal arrhythmia. Risk factors for SCD include a family history of SCD, a history of heart disease, and a history of arrhythmia. Other risk factors include high blood pressure, high cholesterol, and smoking. SCD is a leading cause of death in young people, and it is important to be aware of the risk factors and to seek medical attention if you experience any symptoms.

At a recent seminar, I learned that SCD is a leading cause of death in young people. We are fortunate to have a family history of SCD, but we are not immune. It is important to be aware of the risk factors and to seek medical attention if you experience any symptoms. SCD is a sudden, unexpected death of a person with no obvious structural heart disease. It is often caused by a sudden increase in heart rate, which can lead to a fatal arrhythmia. Risk factors for SCD include a family history of SCD, a history of heart disease, and a history of arrhythmia. Other risk factors include high blood pressure, high cholesterol, and smoking. SCD is a leading cause of death in young people, and it is important to be aware of the risk factors and to seek medical attention if you experience any symptoms.

I am grateful for the information I received at the seminar. It is important to be aware of the risk factors and to seek medical attention if you experience any symptoms. SCD is a leading cause of death in young people, and it is important to be aware of the risk factors and to seek medical attention if you experience any symptoms.

Risk Factors Revisited¹

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Coronary heart disease is the major public health problem in the United States today, and is responsible for the death of almost 700,000 individuals annually in this country. Despite the advent of many technical innovations, including coronary care units, EKG monitoring, antiarrhythmic drugs, pacemaking, cardioversion and defibrillation, and closed-chest cardiopulmonary resuscitation, most patients who succumb to heart attack do so without access to these potentially life-saving forms of treatment. Furthermore, it appears likely that even wider use of these techniques in the prehospital phase of acute myocardial infarction will not solve the problem of mortality from coronary disease.

As we attain a plateau of effectiveness of these various technological interventions, we are gradually turning our attention to the larger population of patients in the community who are at risk for heart attack, who as yet show only minor or latent manifestations of their disease. The problem is a very different one in these potential patients from that in the acutely ill patient with heart attack: The clinician sees a very large number of patients with potential coronary artery disease without knowing which of them will actually develop it; the indicators of potential disease, or 'risk factors', provide only a broad guideline as to what may happen in an individual patient and do not successfully predict the outcome in everyone; 'risk factors' may be present in varying degrees and magnitude of importance, but often the prospect of completely normalizing all risk factors is not present; whereas clinical coronary artery disease often

1 Supported by NHLI Grant No. 14646, 71-2498, HE 07299, RR-533, and American Heart Association Grant No. 71-1016.

Table I. Risk factors

Remediable	Irremediable
Hypertension	hereditary factors
Cigarette-smoking	male sex
Elevated cholesterol, triglycerides	advancing age
Glucose intolerance	
Sedentary existence	
Obesity	
'Stress'	

presents as a discrete event, such as heart attack, arrhythmia or angina, each of which requires a therapeutic solution, presence of 'risk factors' usually causes no symptoms, is often connected with activities which are considered pleasurable, such as cigarette-smoking or overeating and, usually, when corrected produces no immediately visible reward; in acute coronary artery disease a successful intervention often produces immediate benefits to the patient, whereas in preventive therapy the gratification is greatly delayed.

Several of these features may make the problem of preventive therapy difficult, but the magnitude of the problem requires us to make the attempt. A number of groups have carried out elegant studies of the epidemiology of coronary heart disease over the past few decades [8, 11, 17], and precisely quantified 'risk factors' have been developed to enable us to assign relative importance to findings in patients [2]. Some risk factors which have been identified as important are systolic and/or diastolic hypertension [10], family history of premature coronary artery disease, cigarette-smoking [3], male sex, elevated serum cholesterol and/or triglycerides [8], electrocardiographic abnormalities including left ventricular hypertrophy [9], ventricular premature beats [1, 12], and other changes such as conduction disturbances, advancing age, glucose intolerance [4], obesity, sedentary existence [15] and 'stress' [6].

At first glance such a host of risk factors embracing so many aspects of our environment may create the impression that little can be done, and this perhaps fostered the notion in former years that coronary heart disease and other forms of atherosclerotic cardiovascular disease were a natural concomitant of the aging process with little prospect for preventive therapy.

However, with current availability of carefully worked out prospective studies, such as the Framingham study, it has become clear that certain of these risk factors pose greater hazards than others, and so may be amenable to specific attack. Furthermore, a careful scrutiny of the list of risk factors and rearrangement in the format shown in table I, indicates that they can be divided into risk factors which are inherent and irremediable and those which can be altered. The therapeutic approach to several risk factors lies along common lines, and the high-risk patient may, in fact, be able to correct several of these at once. Thus, by losing weight, giving up cigarette smoking, taking medication if necessary for hypertension and substituting judicious physical exercise for emotional stress, a patient may lower his blood pressure, cholesterol, triglycerides and weight, and perhaps effect an appropriate adjustment in his emotional response to stress as well.

Although this approach to the prevention of coronary artery disease is relatively new, and represents a welcome replacement to the nihilistic outlook of former years, much work needs to be done. Some would argue that association does not prove causation and, indeed, it has not yet been definitively proven that control of some of these factors will, in fact, prevent coronary disease. For example, there is relatively secure evidence that reduction of blood pressure will lower the incidence of stroke, but this has not yet been established for coronary artery disease [18]. However, evidence that cessation of cigarette-smoking lowers the incidence of coronary artery disease is quite firm [3]. There is evidence in some studies that lowering serum lipids by altering diet reduces the incidence of new coronary events both when employed for secondary prevention, after development of coronary heart disease [13] and also for primary prevention in asymptomatic populations [16]. Some reports suggest that increased activity level lowers the incidence of coronary artery disease [15], but these are not yet considered definitive. Indeed, the magnitude of the task of obtaining proof that altering risk factors will alter the incidence of coronary artery disease is amply illustrated by the National Diet Heart Study, which indicates that a very large number of patients would have to faithfully follow dietary restriction over a long period of time to provide the necessary evidence [14]. Despite these reservations, it seems wise to acknowledge the importance of these risk factors and to institute preventive therapy where this is possible in an attempt to stem the tide of advancing coronary artery disease.

It may also be important to examine which risk factors are most

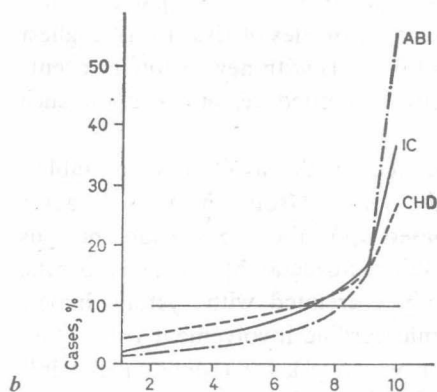
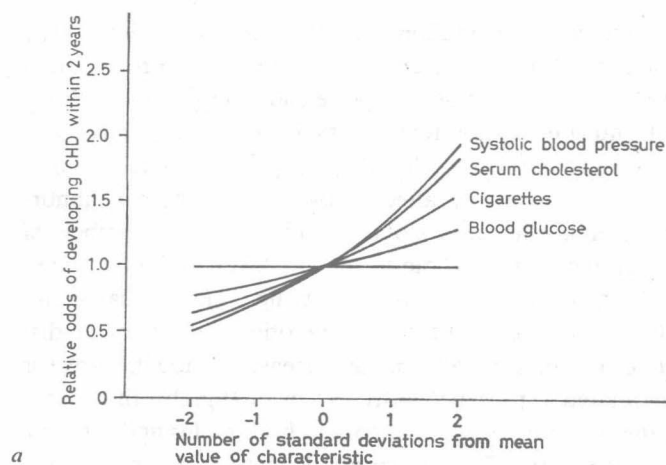


Fig. 1. a Odds of developing clinically manifest coronary heart disease (CHD) within 2 years in relation to deviation from the normal of systolic blood pressure, serum cholesterol, number of cigarettes smoked per day and blood glucose level. Men ages 45-74. **b** Percent of total incidence of atherothrombotic brain infarction (ABI), intermittent claudication (IC) and coronary heart disease (CHD) in each decile of multivariate risk based upon 4 risk factors shown above, plus age and presence or absence of left ventricular hypertrophy on EKG. Data taken from 16-year follow-up of Framingham study. [By permission, J. amer. med. Ass., from GORDON and KANNEL, 7.]

hazardous and to make recommendations based on this knowledge. The results of the Framingham Study have caused investigators to focus upon 4 remediable factors, namely systolic hypertension, cigarette-smoking, elevated cholesterol and glucose intolerance, as regards the relative risk associated with an abnormality in each category [7]. Incidence of new coronary artery disease is adversely affected by each of these 4 abnormalities, in order of importance: systolic blood pressure, number of cigarettes smoked, level of serum cholesterol and level of blood sugar, although differences between them are not great (fig. 1a). The same risk factors are present for other forms of atherosclerotic cardiovascular disease, including stroke and peripheral vascular disease, although stroke is clearly more closely related to presence of hypertension (fig. 1b). In general, risks increase with the presence of these factors in both males and females, although some exceptions exist. In analyzing risk factors in a population of patients, it seems most appropriate to identify high-risk patients such as those shown in figure 1b to be in the upper deciles of risk. In the highest decile of risk approximately 25% of all patients with new coronary events appear, making it possible to concentrate limited resources upon such patients as these [7].

This process has now been facilitated by the availability of tables, based upon the results of the Framingham Study, from which a risk factor can be ascribed to every individual, based upon the above 4 factors, plus age, sex and presence or absence of left ventricular hypertrophy on the electrocardiogram. The latter is closely correlated with systolic hypertension and presumably reflects ischemic cardiac involvement from long-standing hypertension [9]. Tables from which risk for individual patients may be accurately assessed are available from the American Heart Association, and are recommended for use by practicing physicians in directing care for their patients [2].

The problem of sudden death in relation to risk factors deserves special consideration, since over 50% of deaths from acute myocardial infarction are sudden and occur outside the hospital. Risk factors in general appear to predispose to sudden death as they do to development of other coronary events, but the presence of left ventricular hypertrophy on electrocardiogram, i.e. evidence of active myocardial ischemia, and perhaps also cigarette-smoking, may especially predispose to this complication. Much work is also in progress to determine the risk associated with the finding of ventricular ectopic beats on the electrocardiogram, and some evidence is present to suggest that the risk of sudden death is in-

creased in both asymptomatic individuals [1] and in those with known coronary disease [12]. The former finding is not, however, supported by all studies [5]. Nor have the relative merits of treating such arrhythmias with antiarrhythmic drugs, in relation to the complications posed by giving these agents, been established. However, the magnitude of the problem makes further studies of this particular aspect of risk factors especially pertinent for study in the future.

Summary

There is growing and increasingly firm evidence that certain remediable risk factors predispose to coronary artery disease. The most important of these appear to be systolic hypertension, cigarette-smoking, elevated blood lipids and glucose intolerance. When electrocardiographic left ventricular hypertrophy is also detected, a considerable further element of risk is imposed. Left ventricular hypertrophy and cigarette-smoking may predispose to sudden death. Tables are now readily available for assigning each patient a risk factor, and physicians can place their patients on an active program to reduce risk factors and possibly to prevent development of coronary artery disease. Despite lack of absolute proof that such programs will be efficacious, the information presently available to us suggests that this represents a prudent approach to preventive therapy of this major international health problem.

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Mobile Emergency Care Units

Implementation and Justification

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Introduction

The high mortality in the prehospital phase of myocardial infarction [1-4] led to the concept of mobile coronary care units, initially in Moscow in 1957 [5], next in Belfast [6] and then in many cities in the United States [7]. The majority of these mobile units was staffed by physicians and nurses, and the American version of the vehicle rivalled the Apollo capsule in complexity and expense. Unfortunately, most communities were not and are not blessed with unlimited finances and unlimited professional personnel, so the mobile coronary care unit concept was rightfully challenged on financial as well as scientific grounds [8-10]. The financial climate in the scientific community took a turn for the worse in the late 1960s, and unlimited federal support of idealistic ventures rapidly became 'inoperative'.

Over 3.5% of American population resided in Los Angeles County in 1969 and, based on national mortality statistics for cardiovascular disease (600,000 deaths per year), it was predicted that 20,000 residents of this metropolitan area would succumb to cardiovascular disease yearly¹ and probably over one-half of these deaths would occur outside the hospital. An unknown number, perhaps 5,000-10,000, would succumb with a 'heart too good to die', as a result of primary arrhythmic death, potentially reversible. Although it was not possible to put a dollar figure on the worth

1 Actual data is now available for Los Angeles County 1969-1970. There were 18,596 cardiovascular deaths, 91% attributed to ischemic heart disease. (Data derived from Los Angeles County Community Diagnosis Project, prepared by J. M. CHAPMAN and A. H. COULSON, 1973.)