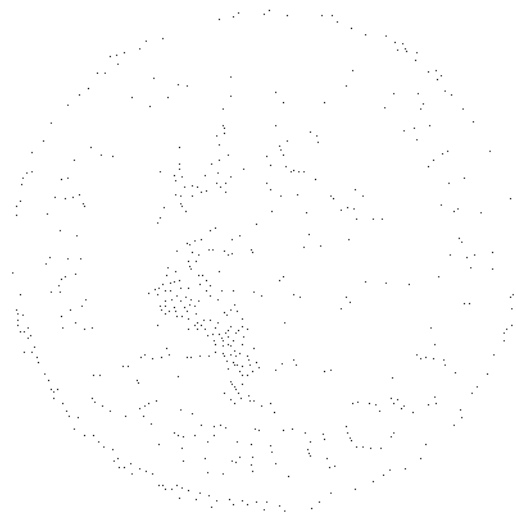


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20TH BETHESDA CONFERENCE

**Insurability and Employability of the Patient
With Ischemic Heart Disease**

Elsevier

20th BETHESDA CONFERENCE

**Insurability and Employability of the Patient With Ischemic
Heart Disease
October 3-4, 1988**

BETHESDA CONFERENCE REPORT**20th Bethesda Conference: Insurability and Employability of the Patient With Ischemic Heart Disease***

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This Conference, sponsored by the American College of Cardiology and co-sponsored by the Association of Life Insurance Medical Directors of America, was held at Heart House, Bethesda, Maryland, October 3 to 4, 1988.

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20th BETHESDA CONFERENCE: INSURABILITY AND EMPLOYABILITY OF THE PATIENT WITH ISCHEMIC HEART DISEASE

Robert F. DeBusk, MD, FACC, Chairman

Introduction

ROBERT F. DEBUSK, MD, FACC

Background

Insurability and employability are major issues for patients with ischemic heart disease and for the physicians caring for them. Physicians often perceive that these issues hinge less on determinations of cardiac impairment, with which they are familiar, than on administrative considerations, with which they are not. Similarly, insurers and administrators within business and government often perceive that determinations of cardiac impairment by physicians, on which determinations of insurability and employability rest, are not adequate. Bethesda Conference 20 was the first nationwide conference involving cardiologists to consider these issues in patients with ischemic heart disease. The Conference arose from the desire of the Bethesda Conferences Committee of the American College of Cardiology to bring physicians and nonphysicians together to address these important issues.

A variety of important medical developments have influenced the insurability and employability of patients with ischemic heart disease in recent years. These include refinements in methods to evaluate prognosis and functional capacity, improvements in the efficacy of medical and surgical intervention techniques in reducing cardiac symptoms and improving prognosis and a strong secular trend toward a lower mortality from ischemic heart disease.

Other developments influencing insurability and employability include a reduction in the physical effort involved in occupational work due to automation and mechanization, an increase in the mandatory retirement age, the erosion of retirement benefits and a long-term trend toward earlier retirement. By the mid-1990s, the number of men aged 55 to 64 years will increase rapidly, replacing a smaller cohort born in the 1930s. The number of individuals afflicted with ischemic heart disease, especially in the 45 to 64 year age

group, will increase rapidly over the next 20 years. Never before has it been so important to define the capacity of patients with ischemic heart disease to remain gainfully employed.

The objective of the Conference was to define policies for insurability that are as equitable as possible and policies regarding employment that maximize the occupational work potential of the patient with ischemic heart disease while protecting the public safety.

The method of the Conference was 1) to achieve a consensus on existing methods to evaluate and enhance prognosis, functional capacity and psychological status, and 2) to consider these methods from an administrative, legal and economic perspective to create new initiatives to enhance the insurability and employability of patients with ischemic heart disease.

Definition of Terms

The important linkage between cardiac aspects of insurability and employability on the one hand and administrative aspects on the other is suggested by the definition of terms adopted by the conference.

Insurability is the ability to obtain insurance for death or disability. Because the basis of all insurance is a sharing of financial risk, the cost and availability of life and disability insurance are related to the severity of heart disease. The medical basis of life insurance is death, whereas the medical basis of disability insurance is largely impairment by cardiac symptoms.

Employability is the ability, viewed from a functional and administrative perspective, to perform gainful work. It is the opposite of disability, which is the lack of ability to perform such work.

Disability is an administrative judgment that an individual's ability to perform gainful work is to some extent limited.

Cardiac disability is an administrative judgment made by nonmedical personnel based on the physician's assessment of the extent of impairment and other factors including age, gender, education, personal motivation, type of employment and the economic and social environment.

Impairment by cardiac disease, as assessed by the physician, is of two kinds: 1) limitation by cardiac symptoms, as assessed by history and various tests of cardiac capacity, and 2) risk for sudden incapacitation even in the absence of limiting cardiac symptoms. This is especially pertinent to such individuals as firefighters, members of police forces and commercial aviators whose sudden incapacitation poses a risk to the public.

Conference Goals and Tasks

The mission and composition of Bethesda Conference 20 were quite different from those of most previous Bethesda Conferences. Most of those were narrow in scope, dealing with issues of particular interest to cardiologists. Most participants were medical scientists. In contrast, the present Conference participants were from many disciplines and perspectives within and outside medicine. This Conference was designed to bring together those involved with medical aspects of insurability and employability and those involved

in the administrative, legal and economic aspects of the problem.

The work of the Conference was divided among four major groups:

1. The Committee on Economic, Administrative and Legal Factors Influencing the Insurability and Employability of Patients with Ischemic Heart Disease. This committee was charged with elucidating current methods and procedures utilized by insurers and administrative agencies in determining the insurability and employability of patients with ischemic heart disease.

2. Task Force I was charged with evaluating currently available techniques for assessing prognosis and changes in prognosis resulting from therapy and changes in the natural history of this condition.

3. Task Force II was charged with evaluating methods for assessing the capability of individuals in a variety of occupations to perform occupational work, with an emphasis on physical capability.

4. Task Force III was charged with evaluating methods for assessing psychological dysfunction in patients with ischemic heart disease, attempting to distinguish between valid and invalid causes for disability compensation for such patients.

COMMITTEE REPORT

Committee Report on Economic, Administrative and Legal Factors Influencing the Insurability and Employability of Patients With Ischemic Heart Disease

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This report reviews how government agencies and private industry use medical information related to ischemic heart disease. The key premises of this conference include the following:

- Ischemic heart disease exerts a significant economic impact on government and industry.
- Advances in medicine are only slowly translated into changes in administrative and legal guidelines.
- Failure of physicians to communicate pertinent information adversely affects the assessment of employability and insurability.
- Many practicing physicians need a better understanding of the administrative and legal guidelines affecting insurability and employability of patients with ischemic heart disease.

As many as 5.4 million Americans exhibit coronary artery disease, manifestations of chronic angina or healed myocardial infarction (1). Treatment of myocardial infarction accounts for the largest component of all hospitalization costs and foregone earnings due to cardiac disease (2).

Factors Influencing Employability of Patients With Ischemic Heart Disease

Mandatory pre-employment physical examinations are rarely performed in the United States today. Employers, cautious about discrimination against individuals based on medical problems, prefer to carry out post-employment placement examinations. Exceptions to this practice are for those occupations in which sudden cardiac incapacitation of the individual could jeopardize the safety of the general public or co-workers. This group includes law enforcement officers, firefighters, airline pilots, air traffic controllers and commercial drivers. This report focuses on the return to work of employed patients with ischemic heart disease.

The major factors influencing the work status of patients with ischemic heart disease are the presence or absence of angina or congestive heart failure, or both (3-7). Other determinants include:

- Severity of heart disease: The number of myocardial infarctions, cardiac damage, severity of angina, complications and physical capacity influence return to work.
- Age: After age 50 years, fewer patients return to work.
- Gender: Women are more likely to withdraw from the work market.
- Social class/education: Those with lower levels of education are less likely to return to work.
- Occupation: Physical activity at work is a factor; manual laborers are less likely than office workers to return to work, although this may reflect psychological rather than physical factors.
- Perceived job stress: Many feel that their jobs contributed to their illness. Fewer return to an unpleasant job.
- Family income: The higher the nonwork income, and the better the disability or retirement benefits, the lower the likelihood of return to work.
- Emotional disturbances: Patients with feelings of anxiety, depression, pessimism, self-perception as being disabled are less likely to return to work.
- Residence (urban versus rural): There is a lower rate of return to work in rural areas, which may reflect the type of work performed.
- Labor market/unemployment/social benefits: Economic and social factors differ among regions of the country. The rate of return to work 12 months after acute myocardial infarction varies from 64% to 90%.
- Lack of cooperation by the employer, usually because of ignorance regarding the capacity for recovery. Economic factors motivate some employers to seek an employee's early retirement through an insured disability program rather than through the standard employer-funded retirement program.
- Attending physician's attitude: A negative attitude on the part of the personal physician may diminish the likelihood of return to work.
- Overprotection by the family: The family's lack of understanding of the patient's degree of recovery affects return to work.

- Delay in evaluating patients.
- Lack of a cardiac rehabilitation program.
- Other medical problems.

A formal occupational work evaluation incorporating exercise testing performed 3 weeks after acute myocardial infarction hastened the return to work of clinically low risk patients (8). Patients undergoing the occupational work evaluation returned to work at a median of 51 days compared with 75 days in controls.

Programs for Establishing Disability from Ischemic Heart Disease

The *American Medical Association Guide to the Evaluation of Permanent Impairment* stresses the difference between "impairment" and "disability." Whereas permanent impairment is a purely medical condition as evaluated by a physician, indicating "any anatomic or functional abnormality or loss," disability is an administrative judgment, indicating a patient's "actual or presumed ability to engage in gainful activity." Although permanent impairment is always considered in determining disability, other factors such as the patient's age, gender, education, personal motivation, type of employment and the economic and social environment must also be taken into account by the administrator when determining disability. More objective measures of functional capability and impairment need to be used in this process.

1. Workers' Compensation

This program evolved from the public's dissatisfaction with the manner in which job related disabilities were handled (9). The system was designed to provide appropriate treatment of work related injuries and prompt and effective disposition of disability cases. The programs are regulated by the states, which, in general, administer their laws through their court systems, a special commission or board or a combination of both. In Canada, administrative activities are carried out by a Provincial board.

Employers are required to provide specified benefits to employees incurring work-related injuries/disabilities. Most employers meet this obligation by obtaining Workers' Compensation insurance from a private insurance carrier or a state-administered insurance fund.

The escalating costs of Workers' Compensation insurance has become a source of concern to employers, insurers, regulators and legislators. Between 1982 and 1986, medical and indemnity losses increased 48% and 27%, respectively. In a 16 state study, the National Council on Compensation Insurance found that angina pectoris and heart attacks accounted for approximately 0.5% of Workers' Compensation cases involving "lost time" (1987). Although few in number, these cases were almost five times as expensive as the average claim (10).

2. Second-Injury Funds

These funds were developed to allocate more equitably the costs of providing disability benefits to workers with preexisting conditions. They were originally developed in response to rulings that an employer would have to bear the full costs of total disability for the loss of the crippled worker's remaining arm or leg. Such rulings discouraged employers from hiring or retaining handicapped individuals.

Employers pay compensation related primarily to the disability caused by the second injury alone. Almost half of the states limit second-injury funds to the loss, or loss of use, of a member or an eye. However, other states allow other preexisting injuries, including myocardial infarctions. Myocardial infarction is increasingly recognized as work related.

3. Pertinent Federal Legislation

A. Age Discrimination in Employment Act of 1967 with amendments of 1978 and 1986. This Act and its amendments prohibit discrimination in employment on the basis of age in such matters as hiring, job retention and compensation. In general, the Act protects workers who are 40 years of age or older. The Equal Employment Opportunity Commission has been charged with interpreting and implementing the Age Discrimination In Employment Act.

An exception to the general rule allows age to be used as a factor in employment decisions where the employer can show that age is a bona fide occupational qualification (BFOQ). Fire and law departments often seek to justify hiring or retirement age limitations as a BFOQ. The BFOQ exception requires an employer to demonstrate a link between the aging process and the demands of a particular job. To prove in court that age is a BFOQ for a particular job, the employer must show that 1) the continued health and safety of public safety officers, said to justify the imposition of an age limit, are essential to the essence of its business, and 2) the employer must rely on age as a proxy for the safety-related job qualifications established in the first prong. To do this, the employer must establish that it has a factual basis for believing that all or substantially all persons within the class would be unable to perform safely and efficiently the duties of the jobs involved, or that it is impossible or impractical to deal with persons over the age limit on an individual basis.

In approximately 20 suits brought by individuals and the Equal Employment Opportunity Commission (EEOC) against state and municipal departments, the courts have, generally, interpreted the BFOQ "escape clause" narrowly (11). Rulings have favored the EEOC in cases in which public safety agencies have not carried out physical screening (particularly with respect to the cardiovascular system) of newly hired workers, required proof of continued good health during employment, allowed exceptions for many physical problems or failed to show that age alone was an important factor in the performance of the job.

Legislation and legal decisions regarding fair employment

Table 1. Legislative Requirements

Occupation	Country	Regulatory Agency	Regulations	Employability	Exam	Exercise Tolerance Test	Reference Source
Railroad engineers	U.S.	AARR	"Guidelines"	Some fulltime; some restricted	R	R	AARR
	Canada (freight only)	National	Yes	Same	R	R	CPCNRR
Commercial drivers, including Bus and Truck	U.S.	Bureau of Carrier Safety Sect. 391.41 (b) (4)	Yes	Some	R	S	11
	Canada	Provincial	Yes	Many	R	R	19-21
Private auto drivers	U.S.	States	Varying	Most	NR	NR	
	Canada	Provincial	Yes	Most	R	R	19-21
Civilian airmen	U.S.	FAA	Yes	Rare	R	R	12
Flight air traffic controllers	U.S.	FAA	Yes	Few	R	R	13

AARR = Association of American Railroads; CPCNRR = Canadian Pacific and Canadian National Railroads; Exam = examination; FAA = Federal Aviation Authority; NR = not required; R = required; S = suggested.

practices have affected the hiring and retirement practices of most employers. Except in cases affecting public safety, employers cannot inquire as to a person's past or present medical status, but must accept the employee as is. Pre-employment physical examinations have been largely replaced by post-employment examinations directed at the identification of preexisting health problems and appropriate job placement.

B. Standards for public safety officers. The thoroughness with which public safety officers are evaluated for the possibility of heart disease varies greatly.

Police officers. There are no national standards. The standards utilized by the Connecticut State Police are representative of many state and local department standards. New hires must be healthy; have a normal rest ECG; if over age 35, have a normal exercise test; have no more than 25% body fat (height and weight criteria are no longer used); complete an agility course; have uncorrected vision, no worse than 20/50 corrected to at least 20/30; have blood pressure of 140/90 or less; and have a serum cholesterol level of 240 mg/dL or less. After hire, there are neither mandatory nor ongoing standards for physical performance nor periodic examinations to determine current health status.

Firefighters. The National Fire Protection Association's publication "Firefighter Professional Qualifications" (1987 Edition) includes the following causes for rejection due to heart disease: valvular heart disease; myocardial infarction or angina pectoris; electrocardiographic (ECG) evidence of major arrhythmias, conduction defects, coronary insufficiency, myocardial infarction or heart muscle disease; cardiac hypertrophy or dilation; pericarditis, endocarditis or myocarditis (except for a single episode of idiopathic or

Coxsackie pericarditis); persistent tachycardia of 100 or more. However, as with law enforcement agencies, it appears that most fire departments do not require continued good health after hire.

C. "Heart laws". As applied to police and firefighters, these laws state that the development of hypertension or heart disease is the result of their employment, without regard to medical evidence. Twenty-eight states have mandated such benefits for firefighters and nineteen states for police officers. Most states allow municipal employers to contest the job relatedness of the disability, in an effort to exclude patently ineligible claimants (12).

In states not allowing this "rebuttable presumption" provision, the costs of disability under the Heart Law have more than doubled in 5 years. In many states, myocardial infarction occurring during duty, is considered work-related, even if there is evidence of prior ischemic heart disease. These laws are increasingly burdensome to municipalities, an increasing number of which are unable to obtain Workers Compensation insurance. In the private sector, employees usually must prove that an unusual stress was the precipitating factor in the appearance or aggravation of underlying heart disease. Legislative requirements for other groups of individuals are summarized in Table 1.

D. Disability criteria of the Social Security Administration for workers with ischemic heart disease (13). Disability allowances for ischemic heart disease depend on the presence of typical anginal chest pain or status anginosus or variant angina of the Prinzmetal type along with objective evidence in the form of rest ECG changes, changes on treadmill exercise testing, obstructive lesions demonstrated by coro-

nary angiography, or impairment of left ventricular contractility demonstrated by left ventriculography.

The specific characteristics of the typical anginal chest pain are:

Precipitation by effort and relief by sublingual nitroglycerin, rapid acting nitrates, or rest. This pain is classically described as crushing, squeezing, burning, or oppressive chest pain that may also be felt in the throat, arms or hands.

If the medical evidence includes the results of a treadmill test, this evidence is the primary basis for adjudicating claims. *The criteria for a positive treadmill test are as follows:*

1. Horizontal or downsloping depression (from the standing control) of the ST segment to ≥ 1.0 mm in at least two consecutive complexes lasting for at least 0.08 s after the J junction; or
2. Junctional depression occurring during exercise, remaining depressed (from the standing control) to ≥ 2.0 mm for at least 0.08 s after the J junction (the so-called slowly upsloping ST segment) in two consecutive complexes; or
3. Premature ventricular systoles that are multiform or sequential (3 or more); or
4. ST segment elevation (from the standing control) to ≥ 1.0 mm; or
5. Development of second or third degree heart block.

In the absence of an acceptable treadmill test, the following may be used as objective evidence:

- I. Rest ECG
 - A. Evidence of transmural myocardial infarction; or
 - B. Ischemic ST segment depression (≥ 0.5 mm); or
 - C. Ischemic configuration or current of injury with ST segment elevation of ≥ 2.0 mm; or
 - D. Symmetric T wave inversion of ≥ 5.0 mm in any two leads except III, aVR, V₁, V₂; or
 - E. Inversion of T waves to ≥ 1.0 mm in any of leads II, aVL, V₂ to V₆ in the presence of an R wave of at least 5.0 mm in lead aVL and an R wave greater than the S wave in lead aVF; or
 - F. Complete left bundle branch block unless there is a coronary angiogram of record that is negative.
- II. "Double" Master Two-Step Test
 - A. Ischemic ST segment depression of > 0.5 mm lasting for at least 0.08 s beyond the J junction in at least two consecutive complexes in any lead; or
 - B. Development of second or third degree heart block.
- III. Cardiac Catheterization
 - A. Angiographic evidence
 1. $\geq 50\%$ narrowing of the left main coronary artery; or
 2. $\geq 70\%$ narrowing of a proximal coronary artery

Table 2. Social Security Administration Statistical Data (15): Disability Allowances for All Causes

Year	Disability Allowances	Men	Women	Age Distribution (men and women) (%)		
				<35 yr	35 to 49 yr	>50 yr
1983	311,490	215,460	96,030	16.6	22.1	61.3
1984	357,140	243,949	113,191	15.9	23.5	60.6
1985	377,371	254,085	123,286	16.9	25.1	58.1
Disability Allowances for Ischemic Heart Diseases						
1983	33,634	28,237	5,397	1.0	16.6	82.5
1984	34,223	28,227	5,996	0.8	15.9	83.2
1985	34,690	28,352	6,338	0.7	14.9	84.4

(left anterior descending, left circumflex, right); or

3. $\geq 50\%$ narrowing of a long (> 1 cm) segment of a proximal coronary artery (left anterior descending, left circumflex, right).

B. Left ventriculography—abnormal wall motion and/or left ventricular ejection fraction of $\leq 30\%$ measured by contrast or radioisotopic methods.

The degree of residual impairment is the primary factor used by the Social Security Administration in determining disability. However, determination of residual impairment is not a uniform process. For example, an individual complaining of chest pains, presumed to be angina, after a myocardial infarction is generally considered disabled even in the absence of an exercise treadmill test. Another individual with similar symptoms who completes stage 3 of the Bruce exercise test protocol after an acute myocardial infarction, may be denied disability. Uniform standards for objective determination of the degree of residual impairment are needed.

The economic impact of Social Security Administration disability allowances. Approximately 2.65 million disabled workers and 1.25 million dependents receive Social Security Administration disability payments at an annual cost of \$17 billion. Approximately 30% of the total cost and 13% of total claims is due to cardiovascular disease.

Disability allowances granted by the Social Security Administration in fiscal years 1983, 1984 and 1985 are shown in Table 2.

Factors Influencing Insurability of Patients With Ischemic Heart Disease

Insurance companies have the responsibility to treat all of their policyholders fairly by establishing premiums at a level consistent with the risk associated with the health status of the policyholder (14).

Underwriting. Underwriting is generally defined as the process by which an insurer determines whether or not and on what basis it will accept an application for insurance. The primary goal of underwriting is the prediction of future mortality and morbidity costs. Underwriting is necessary to prevent adverse selection, which is the tendency of persons with poorer than average health expectations to apply for insurance to a greater extent than persons with average or better health expectations. Antiselection results in inequitable treatment of the healthiest group because it results in the subsidization of high risk individuals by those at low risk.

The insurability (for life, health or disability coverage) of individuals with ischemic heart disease is based on an evaluation of the severity of the disease, both clinically and as indicated by laboratory studies. Significant risk factors for accelerated ischemic heart disease also influence prognosis and, therefore, influence insurability decisions.

The following factors are considered in evaluating applications for insurance coverage:

I. Age and gender

II. Clinical history

Myocardial infarction, number and severity; angina, stable/unstable, functional class; significant arrhythmias; congestive heart failure or other cardiac symptoms such as undue dyspnea on exertion, fatigue; cardiac enlargement i.e., heart size; need for medications i.e., vasodilators, beta-blockers, etc.; associated medical conditions such as hypertension, diabetes; angioplasty; aortocoronary bypass surgery with internal mammary artery or saphenous vein grafts, or both

III. Special studies

- ECG findings; i.e., residual changes of myocardial infarction, stability of ST-T configurations in successive tracings; exercise tests
- Exercise tests, including exercise-induced ischemia, arrhythmia; exercise tolerance; and blood pressure responses
- Echocardiography
- Thallium scans and other radioisotope studies
- Ambulatory ECG arrhythmias and/or silent angina
- Left heart catheterization with left ventriculography and coronary angiography: left ventricular end-diastolic pressure; left ventriculography, including contractile abnormality, number of abnormal segments, degree of abnormal contraction and left ventricular ejection fraction
- Coronary angiography—number, severity and location of coronary artery obstructions

IV. Major risk factors for ischemic heart disease

- Cigarette smoking or other use of tobacco
- Family history

- Hypertension
- Blood lipids—total serum cholesterol, low density lipoproteins, high density lipoproteins, triglycerides
- Diabetes mellitus
- Obesity

Most life insurance policies are issued on an individual basis and individually underwritten with the premiums based on that individual's age and current physical status. As of January 1, 1987, \$3.7 trillion of individual life insurance and \$3.0 trillion of group life insurance were in force in the United States. Of those insured, 60% are male and 85% are between age 20 and 59 years (15,16). The cost of life insurance has diminished steadily over the last 20 years, reflecting lower mortality due to advances in medicine, changes in life style and other factors.

In contrast to life insurance, most health and disability policies are issued on a group basis. In 1987, some 158 million Americans under the age of 65 were covered by some form of group health insurance, and 9 million were covered solely by individual health insurance policies. Causes for the increase in costs of health and disability policies over the past 15 years include advances in medicine, the malpractice crisis and inflation in general.

Insurers underwriting group life and health insurance consider only the relevant characteristics of the *group*, not of the individuals who constitute the group. The premise of group underwriting is that within any large group of individuals (especially in the workplace), only a few harbor medical conditions that would, by individual underwriting standards, warrant either a substandard rating, (an extra premium) or a declination of the risk. The entire group (including the poorer risks) is insured without regard to preexisting conditions when an employer changes carriers. The poorer risks are passed back and forth when employers change carriers on a "no profit—no loss basis." The only exception to this rule concerns late entrants into a group plan. Late entrants are usually required to show proof of insurability, inasmuch as they and their families exhibit an increased incidence of significant health problems.

Individual insurance policies for health or disability are underwritten on a per case basis usually with full disclosure of the prior medical history. There may be an exclusion for preexisting conditions and a 2 year period of contestability (the period of time during which an insurance carrier can challenge the validity of the contract). The care with which writers of individual insurance screen applicants for ischemic heart disease reflects the dramatic rise in medical costs associated with heart disease. The expensive high technology used in the diagnosis and treatment of ischemic heart disease today has been made possible by the sharing effect created by widespread health insurance.

Availability of insurance and ratings. Patients with history of ischemic heart disease applying for individual life, disability and medical care coverages are required to pay

higher premiums for these coverages because of the higher probability of a claim payment (death claim, disability claim, or claim for reimbursement of medical expenses) by the insurer. Some applicants will be denied coverage altogether.

Life insurance. Most applicants for life insurance who have survived a myocardial infarction will be able to buy life insurance 6 months after the episode. A typical rating for a patient who has recovered from an acute myocardial infarction is 175% plus \$15 × 8 years. The applicant pays a premium that is 175% of standard select insured rates over the life of the policy. In addition, he or she pays \$15 extra per 1,000 dollars of coverage for the first 8 years of the policy. Many companies have several different classes of myocardial infarction ratings, differentiated by clinical history, ECG residuals, left ventricular function, and so forth.

Applicants for life insurance who have a history of angina are generally insurable. A typical rating for an applicant with stable angina pectoris is 175% plus \$7.50 for 8 years. This rating is less than that for myocardial infarction because of the lower anticipated mortality of this condition. Coverage of applicants with unstable angina, imminent cardiac catheterization, angioplasty or bypass surgery may be postponed for a period of several months.

Disability insurance. Disability income policies are considered *short-term* (up to 6 months) and *long-term* (more than 6 months). Many employers will provide short-term disability benefits (i.e., sick leave) for 3 to 6 months as part of their basic benefit program. Most long-term disability policies provided through an insurance carrier require a 3 to 6 month waiting period before benefits commence. Most long-term disability policies specify that during the first 2 years of disability, the insured need only be disabled from their own occupation. After 2 years, the insured must be considered disabled from "any reasonable occupation for which they would qualify based on their physical status and training." This requirement can be removed by the payment of an increased premium.

Disability insurance is more difficult to obtain than life insurance for applicants with a documented history of coronary artery disease. Companies frequently limit their liability by offering policies with shortened benefit periods (2- or 5-year benefits) and charging an extra premium ranging from 30% to 200% depending on the clinical history. Many applications will be declined outright especially if the patient has documented severe disease or a very recent clinical event.

Medical expense reimbursement (health insurance). As a group, patients with ischemic heart disease incur substantially higher medical expenses than those of the general population. Many insurance companies do not write individual medical expense reimbursement coverage at all. Any offer of insurance extended to such patients would be made after several years free of clinical events, and then only at a

substantially increased premium or with a substantial deductible, or both.

State pools for uninsurables. The majority of Americans have some type of health insurance (i.e., private, Medicare, Medicaid, and so forth). However, some individuals are unable to obtain any type of personal health insurance because of developmental disabilities, physical or mental impairment or chronic health conditions. The number of uninsurable persons in the United States is estimated at 1 million.

Fifteen states currently have risk-sharing pools that provide access to insurance coverage for these high risk individuals. Funding for these programs varies by state but, in general, the programs are designed to be self-supporting through subscriber premiums. Health insurers doing business in the state usually share in the risk.

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TASK FORCES

Task Force I: Determination of Prognosis in Patients With Ischemic Heart Disease

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I. Introduction

This report summarizes information regarding morbidity and mortality in ischemic heart disease as it relates to insurability and employability. *Insurability* requires the assessment and evaluation of risks that may relate to life, disability and health. *Employability* should consider three aspects: 1) the capability of the individual to perform the job, 2) the risk to the individual of performing the job, and 3) the risk to society if the individual is performing the job.

This report focuses primarily on the assessment of risk of patients with chronic ischemic heart disease, including definite or probable angina pectoris, previous myocardial infarction, cardiac arrest or documented significant coronary artery obstruction. It focuses primarily on chronic disease outcomes and does not address the early prognosis of patients presenting with acute myocardial infarction. In addition, the risk to society posed by ischemic heart disease events occurring on the job is considered for individuals without manifestations of coronary artery disease. Prognostic risk focuses primarily on survival, but also encompasses subsequent myocardial infarction. The effects of specific therapies on prognosis and changes in the natural history of the disease are also considered.

II. Sources of Information

Three types of studies that have recently been extensively reviewed (1) concern prognosis in patients with ischemic heart disease: 1) U.S. population statistics, 2) cohort or observational studies, and 3) randomized clinical trials.

U.S. population statistics. These data, obtained from national surveys, census figures and publications from the American Heart Association (2-5), provide limited information for the evaluation of specific individuals, and there are hazards in extrapolating results from specific studies to national statistics (6-8).

Cohort or observation studies. These studies define the population through community or regional surveillance. Findings from these studies can be extrapolated to the U.S. population because the study population is generally repre-

sentative of the U.S. population as a whole. The findings from several large studies (the Framingham Study, Tecumseh Study, Chicago Peoples Gas Company Study, Minneapolis Professional and Business Men, U.S. Railroad Workers studies and the Chicago Western Electric Company study) largely agree with each other. The risk of developing coronary heart disease among asymptomatic individuals as it relates to the initial assessment has been defined by these studies. Estimates from the Framingham Study form the basis of the Coronary Risk Handbook (9).

Most of the detailed information regarding the assessment of risk of individual patients with manifest ischemic heart disease is derived from specific cohort studies of individuals with the disease. In general, these studies provide the most detailed assessment of the importance of characteristics influencing prognosis but suffer from the selection bias introduced from the enrollment process and criterion selection. The Coronary Artery Surgery Study (CASS) trial included a large collaborative patient registry of all individuals catheterized at participating centers (10). Collaborative registries of patients with acute myocardial infarction include the Myocardial Infarction Limitation of Size (MILIS) Study (11), the Multicenter Postinfarction Trial (MPIT) (12) and those coordinated at San Diego (13) and Stanford (14); however, this report focuses primarily on nonacute disease.

Voluntary collaborative registries include the National Heart, Lung, and Blood Institute-Percutaneous Transluminal Coronary Angioplasty (PTCA) registry of patients undergoing percutaneous transluminal coronary angioplasty (15). There are large regionally-based databases describing complete assessment and outcome of patients undergoing cardiac catheterization or other specific procedures at one or more institutions. These include the Duke Database for Cardiovascular Disease (16), the Seattle Heart Watch Study (17), the Cleveland Clinic Registry (18), the University of Alabama Registry (19) and the Emory University Registry (20). Prognostic studies of specific groups of patients undergoing tests or procedures include those from Cedars-Sinai Hospital (21).

Randomized controlled trials. These trials have evaluated not only the outcome of coronary bypass surgery and medical

Table 1. Prognostic Characteristics From the Initial Assessment

Characteristics	Analysis	
	Univariate	Multivariate
Age	CA, CL, D, I, S	CA, D, S
Gender	CA, D, I	CA, D
Risk factors		
Smoking	CA, CL, D, I	CA
Hypercholesterolemia	D, I	
Hypertension	CA, CL, D, I, S, V	CA, CL, V
Diabetes	CL, D, S	CL
Symptoms		
Pain type	D, S	D
Duration	CL, D, S	CL
Course	CA, CL, D, V	CA, D, V
Nocturnal	D	
Frequency	D, S	S
Myocardial damage		
Congestive heart failure or class	CA, CL, D, S	CL, D, S
ST-T wave changes	CL, D, S, V	CL, D, S, V
Ventricular gallop	D, S	D
Cardiomegaly	CA, CL, D, S	CA, D, S
Premature ventricular complexes	D, S	D
History of myocardial infarction	CA, D, V	D, V
Q waves on electrocardiogram	CL, D, S	CL, D
Digitalis use	CA, S	
Diuretic use	CA, S	
Rales	D, S	
Heart murmur	D, S	
Left ventricular hypertrophy	CL, D, S	CL, S
Conduction abnormalities	CL, D, S	CL, D
Peripheral vascular disease	CL, D, E, S	CL, D

CA = Coronary Artery Surgery Study Trial and Registry (10.94-98); CL = Cleveland Clinic Registry (18.103); D = Duke University Database (16.99-101); E = European Coronary Surgery Study (90-93); I = Life Insurance Studies (1.104); S = Seattle Heart Center Watch Registry (17.22.102); V = Veterans Administration Cooperative Trial (87-89).

therapy but also changes in the natural history of ischemic heart disease. Assessments of prognosis provided by these studies are limited by selection bias introduced by who is enrolled in the trial and difficulties in generalizing beyond these subjects of patients. This report summarizes the three largest trials in patients with stable angina: the Veterans Administration Cooperative Trial, the European Coronary Surgery Study and the Coronary Artery Surgery Study.

III. Characterization of Prognosis

A. Prognostic Characteristics From the Initial Assessment

Table 1 shows significant prognostic variables from the initial assessment that have been found to be important in at least two of the seven major studies. Where the relation has been examined for the characteristic alone and found to be significant, an appropriate notation has been made in the

univariate column. Where multivariate analyses have been performed including at least several of the characteristics (uncommon for the randomized clinical trials) and the characteristics have remained important, an appropriate notation has been made in the multivariate column. The prognostic evaluation of a patient with coronary artery disease begins with the physician's initial assessment. Decisions to perform noninvasive testing or cardiac catheterization should be considered in light of what these tests add to the physician's initial assessment.

Clinical perspective versus life insurance perspective on prognosis. Many different characteristics from the physician's initial assessment can be used to predict survival. Their importance as they relate to prognosis depends in part on how an individual's prognosis is considered. The prognostic risk from a life insurance perspective compares the risk of an individual with coronary artery disease with that which would be expected for an individual of similar age and gender. Clinicians generally consider the prognosis from the perspective of the importance of individual characteristics among patients with established disease. This difference in perspective regarding prognosis influences the importance assigned to characteristics from the initial assessment.

Factors affecting prognosis. Among patients with established coronary artery disease, clinical prognosis worsens with age. However, when considered from a life insurance perspective, the relation reverses (relative mortality in ischemic heart disease patients is considerably higher in younger than in older age groups) because the assigned risk of the individual with coronary artery disease is related to the expected risk in a comparable healthy population. Consequently, age is an important prognostic characteristic and of fundamental importance when considered from the life insurance perspective.

Other important prognostic characteristics from the initial assessment include the patient's gender, risk factors, symptoms, evidence of myocardial damage and evidence of associated vascular disease. The importance of gender is marginal in patients with established disease, although this characteristic is very important in operative mortality with coronary artery bypass grafting, most likely related to the smaller size of coronary vessels in women. Risk factors are particularly important in relation to the risk of development of coronary artery disease, but their contribution to prognosis is less important among patients with established disease (16,22). When examined by themselves, they clearly identify subgroups at higher risk, but when considered in conjunction with other characteristics, their contribution is less important. Similarly, psychological constructs such as the type A personality appear to be important in the development of the disease, but evidence of their importance as independent prognostic variables is not convincing.

The presence of significant myocardial damage has been found in all studies to be an important predictor of outcome.

Table 2. Prognostic Characteristics: Treadmill Exercise Testing

Characteristic	Studies (reference no.)		
	Univariate Analysis	Multivariate Analysis	Add to Cardiac Catheterization
ST segment change	23, 24, 27, 105-111	23, 94, 105	105
Treadmill angina	23, 24, 105-107	105	105
Treadmill time or stage	23, 94, 105, 107, 109-112	94, 105, 107, 113	94, 105, 113
Maximal heart rate	23, 94, 105, 111, 114	23, 94	94
Ventricular arrhythmias	23, 105, 115, 116	23	---
Anginal heart rate	117	---	---
Exertional hypotension	24, 118	---	---

In essence, this characteristic reflects the presence and extent of previous myocardial infarction and is often associated with symptoms of congestive heart failure.

Anginal symptoms identify individuals with myocardium at risk, and their tempo reflects the severity of the risk. Longstanding angina reflects longstanding coronary artery disease and, because the disease is progressive in nature, suggests a worsening anatomic severity.

B. Prognostic Characteristics Elicited by Noninvasive Testing

Noninvasive testing has been able to identify high and low risk subgroups of patients with chronic coronary artery disease. In general, studies are relatively small in size and, to provide sufficient events, have often combined end points to include not only death but also myocardial infarction and coronary artery bypass grafting.

The treadmill exercise test. This test has been the most carefully studied and excellent reviews are available (23-26). The studies cited in Table 2 indicate that among the many exercise variables evaluated, the most important prognostic indicators are maximal exercise capacity, increases in systolic blood pressure, and ST segment displacement (depression and elevation) (27). Although uncommon, exertional hypotension and ventricular tachycardia also identify a high risk subgroup of patients. The magnitude of the additional

prognostic information provided by exercise testing is considerable in relation to the initial assessment and comparatively modest where catheterization has been performed (28,29).

Nuclear studies. Important prognostic characteristics obtained with radionuclide angiography and with thallium scintigraphy are shown in Tables 3 and 4, respectively. The radionuclide exercise ejection fraction appears to be the most important prognostic variable. In patients with a normal rest ejection fraction, the change in ejection fraction with exercise and the peak exercise ejection fraction provide virtually identical prognostic information. Perfusion defects in the distribution of two or more coronary arteries, and perhaps the quantitative estimate of the magnitude of hypoperfusion or the uptake of thallium in the lung appear to be the most important thallium prognostic variables. The contributions of radionuclide angiography and thallium scintigraphy to prognostic assessment are similar.

Ambulatory electrocardiography. This has also been performed in large series of patients with acute myocardial infarction and chronic angina. In patients with acute myocardial infarction, two large observational studies (11,12) have shown that frequent premature ventricular complexes on a predischARGE 24 h ambulatory ECG are predictive of impaired prognosis independently of left ventricular function. Similar observations have been made in patients with

Table 3. Prognostic Characteristics: Radionuclide Angiography

Characteristic	Studies (reference no.)	
	Univariate Analysis	Multivariate Analysis
Exercise ejection fraction	119, 120	120
Change in ejection fraction	121	
Rest ejection fraction	119-121	119
Angina		
ECG changes		
Wall motion abnormalities	120	
Exercise time	120	
Rest end-diastolic volume	119	

Table 4. Prognostic Characteristics: Thallium Scintigraphy

Characteristic	Studies (reference no.)	
	Univariate Analysis	Multivariate Analysis
Transient defects	21, 122-124	21, 122, 124
Total or fixed defects	21, 122, 125	123
Degree of hypoperfusion	21	21
Lung thallium uptake	126	126
Exercise ST changes	124, 126	124, 126
Heart rate changes	124	124
Exercise ventricular arrhythmia	124	

Table 5. Prognostic Characteristics: Cardiac Catheterization

	Studies	
	Univariate Analysis	Multivariate Analysis
Ventricular function		
Ejection fraction	CA, D, I, S	CA, D, S
LV score or wall motion abnormalities	CA, CL, D, S	CA, CL, D
Anatomy		
Left main disease	CA, D, I, V	CA, D, V
Number of diseased vessels	CA, CL, D, E, I, S, V	CA, CL, D, S
Proximal LAD	CA, D, S	CA, D
Other proximal disease or jeopardy score	CA, D	CA, D
Mitral regurgitation	CA, D, S	CA, D, S
LVEDP	CL, D, S	CL, D, S

CA = CASS Trial and Registry (10,94-98); CL = Cleveland Clinic Registry (18,103); D = Duke University Database (16,99-101); E = European Coronary Surgery Study (90-93); I = Life Insurance studies (1, 104); LAD = Left anterior descending coronary artery; LV = Left ventricular coronary artery; LVEDP = Left ventricular end-diastolic pressure; S = Seattle Heart Center Watch Registry (17, 22, 102); V = VA Trial (87-89).

congestive heart failure (30), but this relation has not been found in patients with angina requiring cardiac catheterization (31). Premature ventricular complexes occur more frequently in patients with reduced left ventricular function, and their prognostic information overlaps with measurements of left ventricular function (31). Evidence of silent ischemia has also been shown to be related to prognosis, although the data are not fully developed.

Exercise echocardiography. This study may also identify patients with a poor prognosis through assessment of wall motion changes, however, the data are not fully developed.

C. Prognostic Characteristics From the Cardiac Catheterization

Prognostically important characteristics from cardiac catheterization are shown in Table 5. Information from the physician's initial assessment and cardiac catheterization is shown in Table 6.

The prognostically most important characteristics from the catheterization reflect left ventricular function and coronary anatomy. Left ventricular function is usually expressed as the ejection fraction. Anatomic characteristics reflecting myocardial jeopardy include the degree of left main stenosis, the number of significantly diseased major coronary vessels and the presence of proximal disease in the major coronary arteries, particularly of the left anterior descending coronary artery. The severity of mitral regurgitation and elevated left ventricular end-diastolic pressure are also prognostically important.

Important characteristics from the initial assessment combined with the cardiac catheterization are shown in Table 6. The most important predictors of survival are left ventricular function and coronary anatomy. Patients with unstable angina or poor left ventricular function and severe congestive heart

failure have an especially unfavorable prognosis. The presence of other vascular disease, mitral regurgitation and age have also been found to be significant predictors of outcome when considered with information from cardiac catheterization. When examined by themselves, risk factors clearly identify subgroups at higher risk but when considered in conjunction with the characteristics shown in Table 6, their contribution is less important. The importance of gender is marginal in patients with established disease.

Prognostic estimates are most discriminating when all characteristics are considered. For example, consider the prognosis of two patients with three vessel disease and a normal ejection fraction. One is 64, has frequent angina, resting ST depression, peripheral vascular disease, previous myocardial infarction, an ejection fraction of 51% and a 95%

Table 6. Summary of Important Prognostic Characteristics: Initial Assessment and Catheterization

	Studies	
	Univariate Analysis	Multivariate Analysis
Age	CA, CL, D, I, S	CA, CL, D, S
Gender	CA, D, I	CA, D
Risk factors	CA, CL, D, I, S, V	CA, CL, V
Symptoms	CA, CL, D, S, V	CA, CL, D, S, V
Myocardial damage	All	All
Vascular disease	CA, CL, D, E, S	CA, CL, D, E
Conduction abnormalities	CL, D, S	CL, D, S
Anatomy	All	All
LV function	CA, CL, D, I, S, V	CA, CL, D, S, V
Mitral regurgitation	CA, D, S	D, S

CA = Coronary Artery Surgery Study Trial and Registry (10,94-98); CL = Cleveland Clinic Registry (18,103); D = Duke University Database (16, 99-101); E = European Coronary Surgery Study (90-93); I = Life Insurance studies (1,104); LV = left ventricular; S = Seattle Heart Center Watch Registry (17,22,102); V = Veterans Administration Trial (87-89).

proximal left anterior descending coronary artery lesion. The other is 51, has infrequent angina, no peripheral vascular disease or previous myocardial infarction, an ejection fraction of 64% and a distal 75% left anterior descending coronary artery lesion. Expected survival on medical therapy is quite different. Five year estimates from the Duke Database (32) are 42% for the first patient and 92% for the second.

IV. Effects of Therapy on Prognosis

Studies of prognosis in ischemic heart disease must consider the ameliorating effects of therapy, including medical therapy, coronary artery bypass grafting, coronary angioplasty and changes over time in the natural history of the disease.

A. Medical Therapy

The influence of risk factor modification and drug therapy on the prognosis of patients with established disease has been reviewed (1,33). In general, serum cholesterol, hypertension and particularly smoking behavior worsen the prognosis of patients with manifest ischemic heart disease. However, the influence of these characteristics on *recurrent* cardiac events is modest compared with their influence on the incidence of *initial* coronary events (34-41). Although therapy directed at modifying these risk factors remains a prudent recommendation, definitive demonstration of substantially improved survival with risk factor modification in patients with chronic stable angina is limited (40).

Trials of drug therapy in modifying medical prognosis have been largely limited to patients with acute myocardial infarction or unstable angina. Evidence for an improved outcome, due to beta-blocker therapy, is more convincing after acute myocardial infarction (42-44) than in chronic angina (26,45,46). Two studies (47,48) have shown dramatic benefit of aspirin therapy in patients hospitalized with unstable angina. Some benefit for calcium channel blocker therapy may also be present (49). Vasodilator therapy may also improve survival in patients with congestive heart failure including some patients with coronary artery disease (50,51). The evidence for the use of antiarrhythmic therapy is controversial.

B. Coronary Artery Bypass Graft Surgery

The value of surgery in modifying prognosis has been excellently reviewed (1,52-54). In general, the magnitude of the improvement in prognosis is greatest in patients with anatomically extensive disease (left main disease and three vessel disease) or high risk based on clinical evaluation. Improvement is sustained in the first 7 to 8 years after surgery, diminishing thereafter as grafts become occluded (55,56,57). The influence of repeat bypass grafting on prog-

nosis is unknown at present. The improved patency of internal mammary artery grafting compared with saphenous vein bypass procedures may improve or extend survival benefits with surgery (58,59).

Primary characteristics influencing operative mortality include age, body size (identified by gender in many studies), hypertension, prior coronary artery bypass grafting, history of smoking, left ventricular function, extent of anatomical disease, the presence of unstable angina or recent myocardial infarction, cerebral or peripheral vascular disease, and renal or pulmonary dysfunction (60-62) (Hammermeister KE. Seattle Heart Watch 1988 [personal communication]. Pryor DB. Duke Database 1988 [personal communication]). Long-term outcome after coronary artery bypass grafting is influenced by the same characteristics that define the risk in medically-treated patients except that coronary anatomy is much less important.

C. Coronary Angioplasty

The value of angioplasty in modifying prognosis in patients with coronary artery disease is unknown (63,64). The major limitation with respect to long-term prognosis appears to be restenosis occurring within 6 months in approximately one-third of treated patients (65,66).

D. Changes in the Natural History of Ischemic Heart Disease

There is overwhelming evidence that the natural history of coronary artery disease in the United States is improving over time. A recent comprehensive review describes a 42% decline in the age-adjusted mortality rates in the U.S. population between 1963 and 1985 (67). Outcomes have improved for patients with acute myocardial infarction (34,68) and those undergoing coronary artery bypass surgery (69). Improvements for patients with chronic stable angina treated medically are more modest (34,69,70).

V. Consideration of Occupations Posing a Risk to Society

Clinicians are frequently asked to "certify" that it is appropriate for an individual with ischemic heart disease to return to work. Such decisions are especially important in public safety officers, firefighters, pilots, critical process operators (e.g., nuclear power plant operators) and professional drivers. A significant cardiac event such as cardiac arrest or myocardial infarction occurring at a "critical" time in such occupations may adversely affect not only the individual but also the public or coworkers. In "certifying" whether it is appropriate for such individuals to work, the physician should consider not only the risk to the individual, but also the risk to society.

Prognostic concerns about coronary heart disease have led to the mandatory retirement of individuals with demonstrated disease, as well as individuals without manifest disease. These two groups will be considered separately with respect to both the risk to the individual and the risk to society.

A. Asymptomatic Individuals Without Manifest Coronary Disease

In general, there is no convincing evidence that employment in a specific occupation worsens an individual's risk for the occurrence of a cardiac event. A possible exception is firefighting, which entails bursts of heavy physical activity and exposure to heat and psychological stress. The risk of cardiac events in individuals without manifest coronary disease can be estimated with use of standard risk factor equations such as the Coronary Risk Handbook (9) based on the Framingham Study.

Epidemiologic studies suggest that habitual physical exercise may offer some protection against primary or secondary events of coronary heart disease and associated mortality but "falls short of proving" (71) this. The evidence also suggests that the effect of exercise training is outweighed by the other risk factors. There has also been some demonstration that emotional stress and sudden bursts of activity may increase the risk of sudden death, particularly in sedentary individuals (72,73).

Risk factor profiling using techniques such as the Coronary Risk Handbook are accurate and well substantiated. Screening programs to detect individuals without manifest coronary disease should consider such strategies rather than relying solely on individual characteristics such as age, gender, smoking, and others. Exercise testing can further improve the identification of individuals with one or more risk factors (74-77) and can be applied economically to specific occupations (78). In some cases, such as for airline pilots, it may be appropriate to consider further evaluation with radionuclide procedures or coronary angiography, or both, for individuals at increased risk (79-84).

B. Symptomatic Individuals

Whether it is appropriate for symptomatic individuals to return to occupations posing a risk to the public is often difficult to determine. From a prognostic standpoint, the goal is to determine whether the job is likely to place the individual under a stress that would otherwise be unlikely to occur. However, it is difficult to duplicate or simulate on-the-job conditions, such as those encountered in firefighting (85,86), in a standard ECG stress laboratory.

The decision should also consider the status of the patient's disease. The risk of death or infarction is substantially higher in individuals with manifest or symptomatic coronary disease than in those without manifest disease. The

Table 7. Prognostic Characteristics Classified by Pathophysiologic Construct and Weighted According to Power in Predicting Prognosis for Patients With Manifest Coronary Artery Disease

Pathophysiologic Construct	Weight
Myocardial function	
Congestive heart failure	++++
Functional class	+++
Diuretic use	++
Digitalis use	++
Cardiomegaly	+++
S ₃ gallop	+++
Prior myocardial infarction	++
Exercise systolic pressure	+++
Exercise capacity	++++
Ventricular arrhythmias	++
Ejection fraction	++++
Wall motion score or assessment	++++
Left ventricular end-diastolic pressure	++
Myocardial jeopardy	
Angina frequency	+
Duration of angina	+
Level of exercise inducing ischemia	+++
Degree of exercise induced ST segment depression	+++
Exercise systolic pressure	+++
Presence and extent of reversible thallium uptake	+++
Number and distribution of coronary vessels with obstruction	+++
Myocardial ischemia	
Rest or nocturnal angina	+++
Progressive angina	++
Unstable angina	+++
Failure of angina to respond to nitroglycerin	++
ST segment depression on rest ECG	+++

prognostic value of silent ischemia, defined as ST segment depression without chest pain, in patients without manifest coronary artery disease is unknown. For certain groups of patients, such as those with unstable angina, return to work is clearly inappropriate in a setting where the occurrence of a significant cardiac event would place the public at risk. In contrast, individuals without clinical or angiographic evidence of myocardial ischemia after coronary artery bypass grafting have an excellent prognosis (82).

VI. Conclusions

1. Variables from the clinical assessment, noninvasive tests and cardiac catheterization that are important for estimating prognosis include descriptors of myocardial function, myocardial jeopardy and myocardial ischemia (Table 7).

2. Prognosis can be estimated from the clinical examination (history, physical examination, ECG, chest roentgenogram) combined when indicated with one or more noninvasive studies (e.g., exercise test, radionuclide angiography, myocardial imaging or echocardiography) and does not usually require cardiac catheterization except when dictated by regulations or recommendations.

3. Most occupations do not increase the risk of coronary events. In patients with manifest coronary disease, continued employment should be permitted when patients are functionally able to perform the job.

4. Prognosis should be estimated for occupations in which sudden disability might endanger others. For patients with manifest disease, this evaluation should occur at yearly intervals, or more frequently if required by regulation or recommendation. The cost effectiveness of these approaches needs to be evaluated.

5. Prognosis should also be estimated for patients in occupations requiring sudden or sustained high level physical effort or exposure to extremes of hot or cold or to hypoxia, hypercarbia, carbon monoxide or stimuli producing sudden bursts of autonomic activity.

6. Prognosis need not be estimated for individuals without manifest coronary disease, except perhaps for those with occupations in which sudden disability might endanger others. In the latter group, noninvasive assessment may be of value. In some instances, cardiac catheterization may be required to satisfy regulations or recommendations.

7. Although the advisability of return to full-time work of individuals with manifest coronary disease can usually be established a priori, a trial work period may sometimes be necessary.

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