INTRODUCTION

Prolonged hospitalization lasting several weeks, followed by months of restricted physical activity, was the standard treatment of myocardial infarction (MI) until the early 1950s. Indeed, as recently as the early 1970s, patients were routinely hospitalized for 3 weeks after MI. Exercise based cardiac rehabilitation programs were begun in the 1950s to reverse the physical deconditioning and reduced exercise capacity produced by such hospitalizations and attendant, restricted physical activity. Exercise training was central to cardiac rehabilitation efforts, because exercise was one of the few interventions documented to delay the onset of classic angina pectoris before the availability of the beta-adrenergic blocking agents (beta blockers), calcium channel blockers, coronary artery bypass graft surgery (CABG), and percutaneous coronary intervention (PCI) ***(Redwood et al., 1972).***

People who have survived an acute event are at increased risk of a subsequent event, including death, and are therefore the highest priority for preventive cardiology internationally The objectives for these patients are to reduce the risk of further coronary events, improve quality of life and Increase survival ***(Eurospire II Survey, 2001).***

During the past 5 decades, numerous studies have demonstrated a reduced rate of initial CHD events in physically

active people. These findings provide strong evidence that regular physical activity of at least moderate intensity reduces the risk of coronary events, thus leading to the conclusion that physical inactivity is a major CHD risk factor. An even greater impact is seen when the endurance exercise program is of sufficient intensity and volume to improve aerobic capacity ***(Thompson et al., 2003).***

Based upon these observations and the demonstrated benefit of risk factor reduction, cardiac rehabilitation programs have been developed to provide exercise training and counseling on risk factor modification for the secondary prevention of coronary heart disease ***(Ades et al., 2001).***

The term cardiac rehabilitation refers to coordinated, multifaceted interventions designed to optimize a cardiac patient's physical, psychological, and social functioning, in addition to stabilizing, slowing, or even reversing the progression of the underlying atherosclerotic processes, thereby reducing morbidity and mortality ***(Taylor et al., 2004).***

As such, cardiac rehabilitation/secondary programs provide an important and efficient venue in which to deliver effective preventive care. In 1994, the AHA declared that cardiac rehabilitation should not be limited to an exercise training program but also should include multifaceted strategies aimed at reducing modifiable risk factors for CVD ***(Balady et al., 1994).***

Since then, detailed guidelines have been published that clearly specify each of the core components of cardiac rehabilitation/ secondary prevention programs, along with information about the evaluation, intervention, and expected outcomes in each area. Thus, cardiac rehabilitation/ secondary prevention programs currently include baseline patient assessments, nutritional counseling, aggressive risk factor management(i.e., lipids, hypertension, weight, diabetes, and smoking), psychosocial and vocational counseling, and physical activity counseling and exercise training, in addition to the appropriate use of cardio protective drugs that have evidence based efficacy for secondary prevention ***(Balady et al.,2007).***

Although cardiac rehabilitation is often thought of as medically supervised exercise, physical conditioning is just one component. It is also a coordinated program that assesses each patient's clinical condition and risk factors, provides education and support for living a healthier life, and works to prevent repeated episodes of cardiac illness, such as a second heart attack.

AIM OF THE WORK

To evaluate Cardiac rehabilitation program in Ain Shams University on post myocardial infarction patients as regard patients achieving targets for secondary prevention at the end of program.

Chapter (1)

HISTORICAL BACKGROUND OF CARDIAC REHABILITATION

The relative importance of physical activity for patients with so-called "disorders of the chest" was noted some 200 years ago. In 1772, a physician named Heberden published a report describing a six-month exercise program consisting of 30 minutes of daily sawing activity for one of his male patients who had a diagnosed chest disorder ***(Heberden, 1772).*** Parry, in 1799, independently noted the beneficial effects of physical activity in his patients who suffered from chest pain ***(Parry, 1799).*** Although these reports were written long before any formal recognition or definition of coronary artery disease, undoubtedly some of these patients had experienced anginal disease or myocardial infarctions (MIs). This initial, apparently positive attitude toward physical activity was all but forgotten by the time Herrich, in 1912, gave his original clinical description of an acute MI.3 Expressed concern regarding physical exertion and the increased risk of ventricular aneurysm rupture or heightened arterial hypoxemia precipitated the adoption of a conservative treatment approach in which patients were kept at bed rest for six to eight weeks post-MI.

Pharmacological management of cardiac patients was limited. The agents most commonly used were digitalis and

nitroglycerin. The traditional medical management of physical inactivity for coronary patients was reinforced in the 1930s by two physicians, Mallory and White**.** These men found that the necrotic myocardial region transformed into scar tissue after about six weeks. Therefore, they advised a minimum of three weeks in bed for patients with even the smallest MI ***(Mallory and White, 1939).*** Continued limited physical activity was prescribed after patient hospital discharge. Stair climbing often was prohibited in some cases for up to a year. During this so-called convalescent period, the patient's tendency to become an invalid was enhanced. Follow-up medical management gave little advice to patients regarding functional cardiac capacity, stress management, or education about the disability and its limitations. Frequently, patients did not return to work and soon were considered as nonproductive members of society.

Research during the first three decades of the twentieth century focused mainly on better methods of diagnosing and classifying cardiac disorders and simple testing for "circulatory efficiency" ***(Masters, 1929).*** Little emphasis was placed on the actual development or evaluation of the rehabilitation program.

Work evaluation unit

By the late 1930s, many members of the labor force were retired on disability because of cardiac problems. The New York State Employment Service, concerned about the growing numbers of men on disability, decided to investigate the

situation ***(Zohman and Tobis, 1970).*** A survey identified that 80% of the individuals receiving disability were coronary patients who had not returned to their jobs. Furthermore, only 10% had attempted either to retrain for another job or seek a different position in their company.

In 1940, the New York State Employment Service asked the New York Heart Association to assist in evaluating cardiac workers to determine the level of activity the cardiac patient could perform safely. This request eventually led to the establishment of the Work Classification Unit or Work Evaluation Unit ***(Zohman and Tobis, 1970).*** Cardiac work evaluation units were located in teaching hospitals, rehabilitation centers, and community hospitals. Patients were referred by private physicians and employers and from institutions and vocational agencies. At the unit, patients were evaluated for their physical and psychological capacity for work. Cardiologists performed laboratory tests, resting ECGs, and a Masters Step Test.

A variety of health care professionals interviewed the patients. Most evaluations took three weeks to complete and, after a team conference, recommendations were made to the referring party. No formal exercise program was included or prescribed for the patients. The purpose of these units was threefold: 1) to provide a clinical service by using a team evaluation of the work capacity of the cardiac patient and offering an opportunity for appropriate job placement; 2) to

serve as an educational instrument for training physicians and for informing the general public; and 3) to serve as a research organization for studying cardiac patients by looking at the relationship of the causes of cardiac disease to the ability to work. Thus, the cardiac work evaluation unit was an early approach to what we know today as cardiac rehabilitation. Criticism grew, however, in the 1950s over the small numbers of patients being referred and the methods used to classify coronary disability. This situation caused fragmentation of evaluation and care of these patients. Gradually, the effectiveness and success of the units dwindled.

In 1952, Levine and Lown openly questioned the need for enforced bed rest and prolonged inactivity after an MI. Based on work performed in a Boston hospital during the 1940s and spurred by the manpower needs during World War II, they helped liberalize the attitudes among physicians regarding the need for rigid restrictions of activity. From their work, they concluded that long-continued bed rest "decreases functional capacity, saps morale, and provokes complications" ***(Levine and Lown, 1952).*** Their highly published report caught the attention of many and raised numerous clinical questions about the management of cardiovascular disease.

At the Thirteenth Scientific Session of the American Heart Association (AHA) in Chicago in 1953, the noted physician Louis Katz told the medical community that

"physicians must be ready to discard old dogma when they are proven false and accept new knowledge" ***(Katz, 1953).***

The need to continue research on physical activity and to assimilate this new information into the practice scheme for the cardiac patient was emphasized. The application of work physiology principles was stressed.

Turell and Hellerstein recommended a graded step program (a prototype to contemporary cardiac rehabilitation) based on established energy requirements of physical activity and patient exercise tolerance with continual evaluation of cardiovascular function. Thus, the prevailing theme of this period was clinical research on physical activity and its relationship to coronary artery disease. The strength of the new research provided visible evidence to a doubting medical society ***(Turell and Hellerstein, 1958)***.

In 1955, Dwight Eisenhower, then President of the United States, suffered a heart attack in office. His physician was the noted Paul Dudley White, a man strongly committed to the positive effects of exercise. He prescribed graded levels of exercise, including swimming, walking, and golf, for his celebrated patient. This regimen was viewed by many physicians as reckless and inappropriate, especially given the patient's eminence. The result turned out to be so positive for President Eisenhower that he created the President's Youth

Fitness Council, later to be renamed the President's Fitness Council by President Kennedy.

Inpatient cardiac rehabilitation

By the 1960s, numerous studies demonstrated that early activity after an MI safely negates the adverse effects associated with prolonged bed rest ***(Wenger, 1973 and Moss et al., 1977).*** Saltin et al reported that the functional capacity of normal subjects confined to bed for three weeks decreased approximately 33%. Equally important was his finding that an appropriate equal time of training was necessary to restore the subjects to their prebed-rest condition. After three months of twice-daily rigorous exercise programs, all patients exceeded their control states ***(Saltin et al., 1968).*** Inpatient cardiac rehabilitation became more formalized in the sixties primarily through the efforts of Wenger ***(Wenger, 1969),*** and Zohman and Tobis ***(Zohman and Tobis, 1968)*** and Bruce ***(Bruce, 1957)*** in the fifties. The adopted programs instituted early supervised reconditioning during the acute post-MI phase while the patient was still in the Coronary Care Unit (CCU) and during the post-acute phase while the patient was in the step-down unit. The protocol of Wenger et al consisted of a 14-step program of progressively increasing physical activity levels with emphasis in three areas: graded physical exercises, activities of daily living, and educational activities ***(Wenger et al., 1970).*** The program usually was initiated in the CCU after the patient's

clinical condition was stable. Physical activities at this stage required low-level oxygen demand. They included self-care and supervised active and passive range of motion exercises; progressive ambulation was added shortly thereafter. Patient and family education programs paralleled the graded physical activities. This structured plan greatly assisted the patient toward discharge and an early return to normal living. Zohman's program provided exercise using an equicaloric technique that matched the level of energy expenditure with exercise of equal caloric value ***(Zohman, 1973).*** The exercises were monitored by radio telemetry, and energy costs were measured as a check on the rehabilitation activities. The favorable outcome of these structured programs encouraged the development of similar programs around the country. Soon, other hospitals also were experiencing the positive economic implications of early intervention. These included a hastened recovery time and decreased hospital stay; improved functional status at the time of discharge; and in turn, an earlier return to work ***(Cohen and Grant, 1973 and Cohen, 1975).***

Outpatient cardiac rehabilitation

By the end of the 1960s, Hellerstein, a well-known Cleveland cardiologist encouraged by the results of his inpatient program, boldly chose to incorporate physical exercise into a follow-up program after hospital discharge. A formalized study was conducted involving 200 post-MI patients at the Cleveland YMCA and later at the local Jewish Community Center.20

Hellerstein was criticized severely by his peers for his innovative but risky approach. The study clearly demonstrated that cardiac patients could benefit physiologically from regular progressive exercise and enjoy improved psychological confidence without a negative effect on either mortality or morbidity ***(Hellerstein, 1968).*** The success of this medically supervised program offered a new dimension, the outpatient program, to cardiac rehabilitation. As a result of the work of Hellerstein, Wenger, Zohman, and others, the concept of progressive supervised activity for the post-MI patient and the postsurgical patient has taken its rightful role in the practice of medical therapeutics.

Cardiac rehabilitation programs

A comprehensive cardiac rehabilitation program today consists of several phases:

Phase I—Inpatient hospital phase beginning in the CCU

Phase II— Outpatient hospital-based phase for 2 to 4 months

Phase III—Maintenance phase for 4 to 6 months or even up to 12 months.

Each phase has its own objective for patient care and progression. Each phase has an educational component commensurate with the patient's level of knowledge of the disability and level of activity. Most programs today include a graded exercise test not only as a screening procedure but also as a functional evaluation for prescription and progression.

The medical management of patients with coronary disease also has taken a turn toward pharmaceutical management. The use of cardiovascular drugs has opened up many new and effective approaches to the treatment of patients with arrhythmias, angina, hypertension, and other coronary dysfunctions.

Cardiac rehabilitation has increased dramatically in recent years. Inpatient and outpatient programs in the hospital and at community sites are being implemented all over the country. Better equipment and greater experience with exercise and patient education have made cardiac rehabilitation safe and beneficial for the majority of patients with MIs and coronary artery bypass surgery. Equally significant, research over the last 10 years has provided empirical data suggesting that cardiac rehabilitation programs are a safe and effective method of improving physical, physiological, and psychological wellbeing and greatly enhance the quality of life for cardiac patients.

Chapter (2)

CARDIAC REHABILITATION: DEFINITION AND CORE COMPONENTS

Cardiac rehabilitation:

Over a decade ago, the 1995 clinical practice guideline *Cardiac Rehabilitation* from the U.S. Department of Health and Human Services, Agency for Healthcare Policy and Research (AHCPR), and the National Heart, Lung, and Blood Institute ***(Wenger et al., 1995)*** characterized cardiac rehabilitation as the provision of comprehensive long-term services involving medical evaluation; prescriptive exercise; cardiac risk factor modification; and education, counseling, and behavioral interventions. This delineation remains highly relevant and applicable today. Cardiac rehabilitation has been also defined as the sum of activities required to ensure cardiac patients the best possible physical, mental and social conditions so that they may, by their own efforts, resume and maintain as normal a place as possible in the community ***(WHO Expert Committee, 1964).*** The AHCPR guideline highlights the effectiveness of multifaceted and multidisciplinary cardiac rehabilitation services integrated in a comprehensive approach. The goal of this multifactorial process is to limit the adverse physiological and psychological effects of cardiac illness, to reduce

the risk of sudden death or reinfarction, to control cardiac symptoms, to stabilize or reverse progression of the atherosclerotic process, and to enhance the patient's psychosocial and vocational status. Provision of cardiac rehabilitation services, per the guideline ***(Wenger et al., 1995),*** was to be directed by a physician, but implementation could be accomplished by a variety of health care professionals.

Although traditionally most candidates for CR services were patients following myocardial infarction ***(Oldridge et al., 1988)*** or coronary artery bypass graft surgery, contemporary use also includes patients following percutaneous coronary interventions; heart or heart/lung transplantation recipients; patients with stable angina or stable chronic heart failure; those with peripheral arterial disease with claudication; and patients following cardiac surgical procedures for heart valve repair or replacement ***(Williams et al., 2006).*** Indeed, referral for cardiac rehabilitation is a class I indication (useful and effective) in most contemporary clinical practice guidelines, including those for ST-segment elevation MI ***(Antman et al., 2004),*** unstable angina/non–ST-segment elevation MI ***(Anderson et al., 2007),*** chronic stable angina ***(Gibbons et al., 2003),*** PCI ***(Smith et al., 2006),*** CABG surgery ***(Eagle et al., 2004),*** heart failure ***(Hunt et al., 2005),*** valvular heart disease ***(Bonow et al., 2006),*** peripheral arterial disease ***(Hirsch et al., 2006),*** and cardiovascular prevention in women ***(Mosca et al., 2007).***