MEDICAL GRAND ROUNDS

Parkland Memorial Hospital

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Charles B. Mullins, M.D.

EARLY PHASES OF CARDIAC REHABILITATION FOLLOWING A MYOCARDIAL INFARCTION

I know one who set himself
a task of sawing wood for
half an hour every day,
and was nearly cured.....
(of angina).
Heberdon 1802

Overview of Cardiac Rehabilitation

Symptomatic coronary heart disease is an exceedingly common medical problem. It is responsible for approximately 675,000 deaths and an equal number of survivors of acute myocardial infarction, as well as for such other conditions as angina pectoris and chronic heart failure.

Patients with acute myocardial infarction may be classified into two major medical groupings according to severity during the acute phase: uncomplicated and complicated. The medically uncomplicated group accounts for approximately 45% of patients hospitalized with myocardial infarction.[1] This group of patients has a great potential for full rehabilitation because their post-hospital course generally remains uncomplicated. Patients who develop complications during hospitalization may have serious or recurrent arrhythmias, persistent pain, congestive heart failure, shock, ventricular aneurysm or other serious problems. Any of these complications may seriously impair the potential for full rehabilitation if they persist or are accompanied by other serious sequelae. However, many patients whose complications subside during the process of recovery, may assume an uncomplicated post-hospital course and have a favorable rehabilitation potential.

Immediately following myocardial infarction, some heart muscle is irreversibly damaged and the survival of surrounding areas is jeopardized. Preservation of jeopardized areas of myocardium in the immediate acute infarction period may be crucial in determining the patient's ultimate functional state. Techniques for measuring the extent and methods for reducing the myocardial damage are now being developed.

Until recent years, complete and prolonged bed rest and physical inactivity were among the cornerstones of treatment for acute myocardial infarction. This type of treatment fostered physical deconditioning, and the development of thromboembolic complications such as phlebitis and pulmonary embolism. The deconditioning is manifest by a decrease in physical work capacity, increase in the heart rate response to effort, a decrease in circulating blood volume, a decrease in muscle strength, and development of psychological symptoms, including depression. Many if not all of the effects of deconditioning are apparently reversible, but both the physical and psychological symptoms accompanying deconditioning may prolong or totally inhibit the rehabilitation process, and may adversely affect the final outcome in some patients, often with a clot forming in the vein, thromboembolism and pulmonary embolism.

A trend toward earlier resumption of physical activity "early ambulation: has developed, and this appears to limit or prevent the extent of physical deconditioning. When early ambulation is employed in the treatment of the patient with uncomplicated myocardial infarction, it apparently is not associated with increased risk of adverse complications or sudden death. Rather, it may decrease the levels of anxiety and depression, decrease the duration of hospital stay, hasten convalescense, and be associated with an earlier return to work.[2]

The Specific Rehabilitation Program

Definition

The concept that many patients with symptomatic coronary atherosclerotic heart disease--both angina pectoris and myocardial infarction--can and should return toward normal living is the basis of the rehabilitation effort. The responsibility for the restoration of the coronary patient to productive or independent living rests with the primary physician: He may utilize and coordinate the knowledge, skills, and techniques of many disciplines and individuals in this process.

Goals

The goals of a cardiac rehabilitation program are directed toward patient and family:

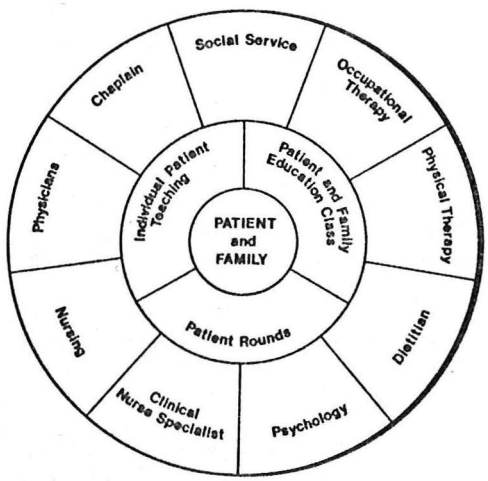
1) Acceptance of the disease
2) Knowledge of the disease
3) Emotional support
4) Continuous compliance

Rehabilitation Team:

The total rehabilitation program is complex and beyond the scope of one individual. Therefore, a team approach is preferred for a well balanced, uniform, and complete program of rehabilitation.

A diagnostic illustration of this teamwork is illustrated below:[3]

CARDIAC REHABILITATION PROGRAM



from Dallas V.A. Hospital
Cardiac Education Program

The team efforts are directed toward restoring the patient to an optimal level of funtioning through medical care, psychological care, resolving social needs, and education.

The role played by the team members may be briefly summarized as follows:

Physician: Solo or team - direct the day to day medical care of the patient, program the "staging process", and assist in education of the patient and his family.

Nursing Staff: Attend to the patient's minute to minute medical and personal health care needs, in close association with the physician. Beginning education and activity levels directed to both the patient and family.

Clinical Nurse Specialist: Coordinates the cardiac rehabilitation program in hospital with direct supervision or teaching the Patient and Family Education classes, perhaps, the key to the entire rehabilitation program!

Psychologist or Psychiatrist: Provides psychologic assessment and vocational counseling to patient and family. May develop group counciling sessions or provide individual therapy sessions as the patient or family require.

Occupational Therapist: A cardiac specialist in rehabilitation supervises and provides activity levels for the patient as the patient is "staged". Conducts formal education classes for the patient and family concerning activities, energy conservation, and if needed individual job analysis and home evaluations after discharged.

Social Service: The social worker coordinates and facilitates group education and counseling sessions and is available for individual sessions if needed. Importantly, initiates referrals to community agencies (approved by the physician) such as vocational rehabilitation agency, Visiting Nurses Association, Social Security, and exercise rehabilitation program.

Dietary: Conducts the dietary education classes for patient and family, provides individual dietary counceling for the patient and family at time of discharge.

Physical Therapy: Assists the patient in sequential exercise programs in hospital and educates the patient on out hospital activity levels that match his functional abilities.

Chaplain Services: Regular pastoral care as needed, an important member of the counseling team.

Formal Education Classes

Every hospital caring for significant numbers of patients with myocardial infarctions should provide formal education classes for the patient and family. These should be weekly scheduled sessions and involve all the health care and rehabilitation team. Below is a general outline of topics to be covered:

Class 1 - Disease and symptoms early warning signs
Class 2 - Risk factors, Drug therapy
Class 3 - Diet
Class 4 - Activity levels
Class 5 - Exercise program, Community resources
Class 6 - Cardiopulmonary resusitation Course for family members - optional[4]

Phases of Rehabilitation

Rehabilitation programs for the acute myocardial infarction patient are best discussed in relation to the phase of the illness. At each phase, the physician formulates a plan to assess and manage the patient's illness, modifying his plan according to the patient's response to therapy. The plan includes evaluation of function (such as the severity of the disease, the complications, the emotional response to illness), monitoring of the desired and the adverse effects of therapeutic maneuvers, and periodic reassessment of function as it is changed by therapy.

Phases I-IV:

Phases I and II involve the acute illness; Phase I includes the time in the coronary care unit and Phase II the remainder of the hospital stay. Phase III is a period of convalescence, generally at home, and usually two to eight weeks in duration. Phase IV can be designated as the recovery and maintenance phase. Its particular concerns include efforts to enhance function, to decrease risk factors, and to prevent the recurrence of progression of the disease.

The needs of the acute myocardial infarct patient for care by various members of the health team vary with the phase of the illness. In the CCU, Phase I, physicians and nurses with specialized training in intensive medical care have the greatest responsibility. The emphasis here is on the control of arrhythmia, shock, and heart failure. However, major emotional reactions that characteristically occur in this phase should not be neglected. The threat of dying can produce anxiety, or the patient may respond to his anticipated restrictions and invalidism with depression.

The patient with a myocardial infarction can be progressed through "Stages" of activity, first in the CCU, Phase I, then in the intermediate care facility, Phase II, then the ward, Phase II, and finally the home environment, Phase III and IV.

Staging: Phase I and II

A well designed staging process for the patient with a myocardial infarction is one developed by Nannette Wenger at Emory University and reproduced below from the American Heart Association Cardiac Rehabilitation booklet.[5] The patient progresses through each stage, usually daily, unless complications or symptoms arise, then slower progression would be indicated.

	Exercise	Ward Activity	Educational & Craft Activity
Step 1	Passive ROM to all extremities (5X ea), teach pt *active* plantar and dorsiflexion of ankles to do several times per day.	Feeding self sitting with bed rolled up to 45°, trunk and arms supported by over-bed table.	Initial interview and brief orientation to program.
Step 2	Repeat exercises of Step #1.	1. Feeding self. 2. Partial AM care (washing hands & face, brushing teeth) in bed. 3. Dangle legs on side of bed (1X).	Light recreational activity, such as reading.
Step 3	Active assistive exercise in shoulder flexion and elbow flexion and extension, hip flexion, extension and rotation, knee flexion and extension, rotate feet. (4X ea).	1. Begin sitting in chair for short periods as tolerated, 2X/day. 2. Bathing whole body. 3. Use of bedside commode.	More detailed explanation of program. Continue light recreation.
Step 4	Minimal resistance, lying in bed in above ROM 5X ea. Stiffen all muscles to the count of 2, (3X).	1. Increase sitting 3X/day. 2. Change gown.	Begin explanation of what is an MI. Give pt pamphlets to read, begin craft activity: 1. Leather lacing. 2. Link belt. 3. Hand sewing, embroidery. 4. Copper tooling.
	Exercise	**Ward Activity**	**Educational & Craft Activity**
Step 5	Moderate resistance in bed at 45° above ROM exercises, hands on shoulders elbow circling (5X ea arm).	1. Sitting ad lib. 2. Sitting in chair at bedside for meals. 3. Dressing, shaving, combing hair—*sitting down*. 4. Walking in room 2X/day.	Continue education about healing of heart, reasons for early restrictions in activity.
Step 6	1. Further resistive exercises sitting on side of bed, manual resistance of knee extension & flexion, (7X ea movement). 2. Walk distance to nearest bathroom and back, (note if patient needs assistance).	1. Walk to bathroom, ad lib if pt can tolerate. 2. Stand at sink to shave.	Continue craft activity or supply pt with another one. Pt may attend group meetings in a wheelchair for no more than 1 hour.
Step 7	1. Standing warm-up exercises: a. Arms in extension and shoulder abduction, rotate arms together in circles, (circumduction) 5X ea leg. b. Stand on toes, 10X. c. May substitute abduction 5X ea leg. 2. Walk length of ward	1. Bathe in tub. 2. Walk to telephone or sit in waiting room (1X/day).	1. May walk to group meetings on the same floor.

from Coronary Care Rehabilitation After Myocardial Infarction, Wenger

	Exercise	Ward Activity	Educational & Craft Activity
Step 8	1. Warm-up exercises: a. Lateral side bending, 5X ea side. b. Trunk twisting, 5X ea side. 2. Walk 1½ lengths of hall, down 1 flight of stairs, take elevator up.	1. Walk to waiting room 2X/day. 2. Stay sitting up most of the day.	Continue all previous craft and educational activities.
Step 9	1. Warm-up exercises: a. Lateral side bending, 10X ea side. b. Slight knee bends 10X with hands on hips. 2. Increase walking distance, walk down 1 flight of stairs.	Continue above activities.	Discussion of work simplification techniques and pacing of activities.
Step 10	1. Warm-up exercises: a. Lateral side bending with 1 lb weight (10X). b. Standing—leg raising leaning against wall, 5X ea. 2. Walk 2 lengths of hall and downstairs, take elevator up.	Continue all of previous ward activities.	1. Pt may walk to OT Clinic & work on craft proj. for ½ hr. a. Copper tooling; b. Woodworking; c. Ceramics; d. Small weaving proj. e. Metal hammering; f. Mosaic tile. 2. Discussion of what exercises pt will do at home.
	Exercise	**Ward Activity**	**Educational & Craft Activity**
Step 11	1. Warm-up exercises: a. Lateral side bending with 1 lb weight leaning against wall 10X ea side; b. Standing leg raising 5X ea. c. Trunk twisting with 1 lb weight 5X ea side. 2. Repeat part 2 of Step 10.	Continue all of previous ward activities.	Increase time in OT Clinic to 1 hour.
Step 12	1. Warm-up exercises: a. Lateral side bending with 2 lb weight 10X. b. Standing—leg raising leaning against wall, 10X ea. c. Trunk twisting with 2 lb weight, 10X. 2. Walk down 2 flights of stairs.	Continue all of previous ward activities.	Continue craft activity with increased resistance.
Step 13	Repeat all exercises of Step 12.	Continue all of previous ward activities.	Complete all projects.
Step 14	1. Warm-up exercises: a. Lateral side bending with 2 lb weight 10X ea side. b. Trunk twisting with 2 lb weight 10X ea side. c. Touch toes from sitting position, 10X. 2. Walk up flight of 10 stairs and down.	Continue all of previous ward activities.	Final instructions about home activities.

from Coronary Care Rehabilitation After Myocardial Infarction, Wenger

A similar program was developed at the Dallas V.A. Hospital by cardiac specialist nurses Cathleen Gazzetta and Linda Little, in conjunction with many other members of the nursing and rehabilitation staff as well as the cardiology staff, especially Dr. Thomas Smitherman. This program has clearly shown its effectiveness in a teaching setting. This valuable program, in its entirely, is reproduced in the appendix.

Staging: Phase III and IV

The process of rehabilitation does not end with discharge, but rather begins with discharge. A staging program for rehabilitation at home and with return to work is outlined in the Appendix, again a very successful program outlined by the Dallas V.A. Hospital. The information booklet is given to the patient to extend his and his family's education, alleviate anxiety and answer their many questions concerning the home rehabilitation process.[1,3,5]

1. Wenger, N. The Early Ambulation of Patients After Myocardial Infarction. Cardiology 58:1, 1973.

2. Report of the Task Force on Cardiovascular Rehabilitation of The National Heart and Lung Institute: Needs and Opportunities for Rehabilitating the Coronary Heart Disease Patient, December, 1974

3. Smitherman, T.C.; Guzetta, C.; Little, L. - Cardiac Education Program Dallas V.A. Hospital

4. Naughton, J.P.; Hellerstein, H.K.; and Mohler, I.C., Eds.: Exercise Testing and Exercise Training in Coronary Heart Disease. Academic Press, New York, 1973.

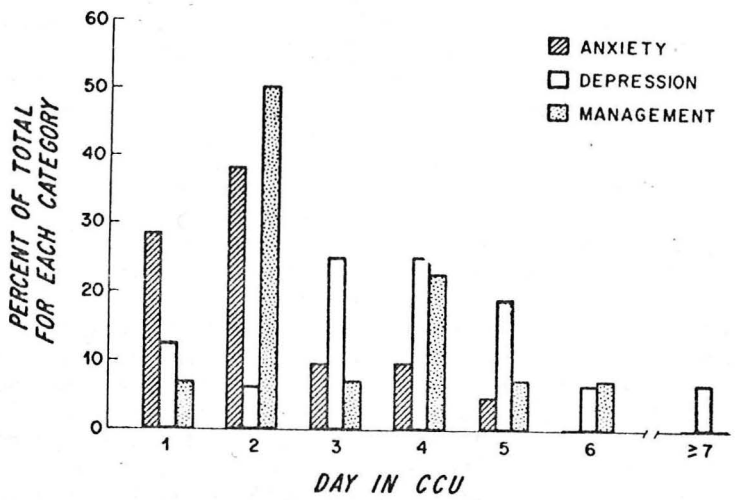
5. Wenger, N.K.: Coronary Care - Rehabilitation After Myocardial Infarction, American Heart Association, New York, 1973.

Psychological Aspects

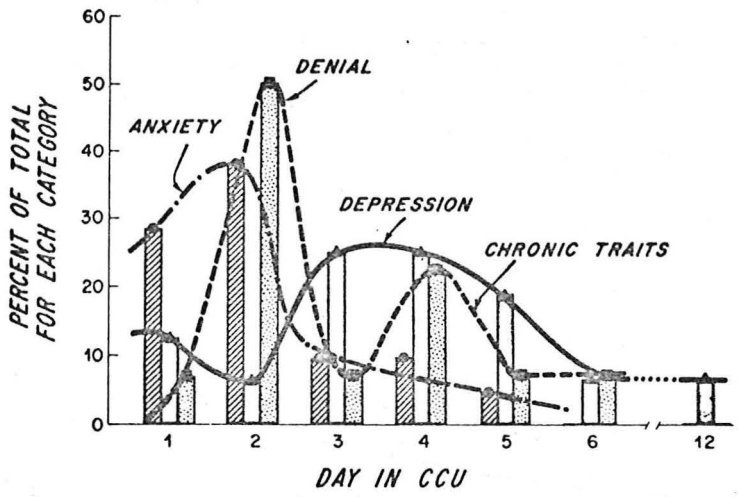
A. Early Phases:

The frequency of psychiatric difficulties in intensive care units range from 30% to 70%. The emotional response of patients to a myocardial infarction is shaped largely by two sources of psychological stress. The first, which occurs during the acute phase of myocardial infarction, is the immediate threat to life. The second, generally experienced by the third hospital day, is the threat that coronary heart disease will irreparably alter the patient's life-style and livelihood. Most patients expectedly, respond to the threat of death by developing anxiety, just as they react to anticipated restrictions and limitations by becoming depressed. The individual patient then learns to cope with the anxiety and depression primarily by the use of denial, which may be overt or covert.

Cassem and Hackett[6] consulted on one-third of all admissions to a CCU and developed the following data and this theortical histogram.



from Cassem & Hackett



from Cassem & Hackett

There are three categories of problems. It is evident that anxiety begins early and peaks by the second day, whereas depression comes to the fore by the third day. If hypothetical curves are superimposed on this histogram and denial is added, it can be seen that the latter acts to stem anxiety, yet bears little or no obvious relationship to depression. Fortunately, anxiety is the easiest symptom with which to contend in treating CHD patients. Realistic reassurance offered by physicians and nurses is of great help in calming patients. The very atmosphere of the CCU with its monitoring devices, alarm systems, and the constant attention to vital signs fosters a sense of protection that releaves apprehension. Finally, a variety of safe and effective tranquilizers can be employed.

The depression may be easily overlooked by the casual observer, its only manifestation may be sleep disturbance, fatigue, or loss of appetite. Except perhaps in those few patients, less than 20%, who almost completely deny their illness, depression is universal. A progressive physical conditioning program beginning on the second or third hospital day, even so modest as passive exercise, can alleviate this depression by providing the reassurance of progressive improvement.

In a study by Wishnie, Hackett, and Cassem[9] eighteen of twenty-four patients were judged by the investigator to require a tranquilizer or antidepressant. This opinion was based upon the following factors: 1) patient's undisguised complaint of fear, apprehension, anxiety, or

depression, 2) bodily agitation such as pacing, sweating, finger tapping, and hand or foot tremor during interview, 3) insomnia and inability to relax during the day, and 4) despondency and emotional lability as related by family. Eleven of the eighteen, while acknowledging the need for medication, refused to ask their physicians for it or to take sedatives already in their possession because they feared "getting hooked on pills."

Delirium occurs in 10% of patients confined to a CCU. This manifests itself most commonly as disorientation to time and place with an occasional patient developing overt paranoid deliriums. Surprisingly, up to 50% of patients develop amnesia to their stay in a CCU when questioned three weeks or later following discharge.

These reactions are most frequently related to drug therapy, especially diazepam (Valium) and lidocaine. The aging patient is the most susceptible to these reactions especially if psychotrophic drugs are prescribed on a continous basis.

A second time of major psychological stress occurs on transfer from the CCU, the patients often have mixed reactions, a) reassurance because of the progression, b) anxiety and depression due to the missed close attention and the removal of the visible cardiac monitor and resusitation equipment. Reassurance at time of transfer with emphasis on improvement will prevent the adverse psychological reaction plus a mild tranqualizer and sleeping medication.

Caution should be exercised in the use of phenothiazine (Thorazine, Stelazine, Mellaril, etc.) to control anxiety. These are antipsychotic preparations and are not to relieve anxiety. Furthermore, they possess hypotensive properties and increase cardiac irritability.

B. Late Phases[6,7,8]

The homecoming depression is common and is expressed by the patient as severe weakness, fatigue, and a sense of dependency and finally, by some, as an overt depression. The patient finds it distressing, often considering the symptoms as a harbinger of permanent cardiac disability. The symptom of weakness must stem from a variety of sources. Deranged cardiovascular physiology, as a result of the myocardial infarction, must play a part, as must the inactivity and resulting inanition typical of coronary heart disease convalescence. Since weakness is a cardinal symptom of depression, it is likely that the latter adds to this sense of exhaustion. The stresses the patient must face in convalescence in late rehabilitation are numerous 1) threat of sudden death, 2) depression due to inactivity and job uncertainty, 3) depression due to deprivations: cigarettes, diet, alcohol and excitement.

Of interest, in several studies, less than a third of patients who agree to lose weight, and/or give up alcohol, and/or give up cigarettes, and/or lose weight do so!

The stress of "homecoming" and early rehabilitation has been shown to be alleviated in the majority of instances by the use of a hypnotic for sleep, since sleep disorders are common during the three months post infarction and the use of mild tranquilizers, especially the benzodiazepines (Librium and Valium).

An occasional telephone call from the physician or nurse during the patient's first two weeks at home has proven to be very effective in preventing depression and anxiety and answering many previously unasked questions.

A physical conditioning program seems to be the most effective "therapy" in preventing depression during the very late phase of recovery.

6. Cassem, N.H. and Hackett, T.P.: Psychiatric Consultation in a Coronary Care Unit, Annals of Internal Medicine 75:9-14, 1971

7. Hackett, T.P. and Cassem, N.H.: Psychological Adaptation to Convalescence in Myocardial Infarction Patients, Exercise Testing and Exercise Training in Coronary Heart Disease, Academic Press, New York, 1973, pp. 253-262

8. Hackett, T.P.; Cassem, N.H.; and Wishnie, H.A.: The Coronary-Care Unit An Appraisal of Its Psychologic Hazards, New Englang Journal of Medicine, 279:1365-1370, 1968.

9. Wishnie, H.A.; Hackett, T.P.; and Cassem, N.H.: Psychological Hazards of Convalescence Following Myocardial Infarction, JAMA, 215:1292-1296,1971.

10. Bruhn, J.G.; Wolf, S.; and Phillips, B.U.: A Psycho-Social Study of Surviving Male Coronary Patients and Controls Followed Over Nine Years, Journal of Psychosomatic Research, 15:305-313, 1971

11. Monteiro, L.A.: After Heart Attack: Behavioral Expectations for the Cardiac, Social Science and Medicine, 7:555-565, 1973

12. Croog, S.H.; Shapiro, D.S.; and Levine, S.: Denial Among Male Heart Patients, Psychosomatic Medicine, 33:385-397, 1971.

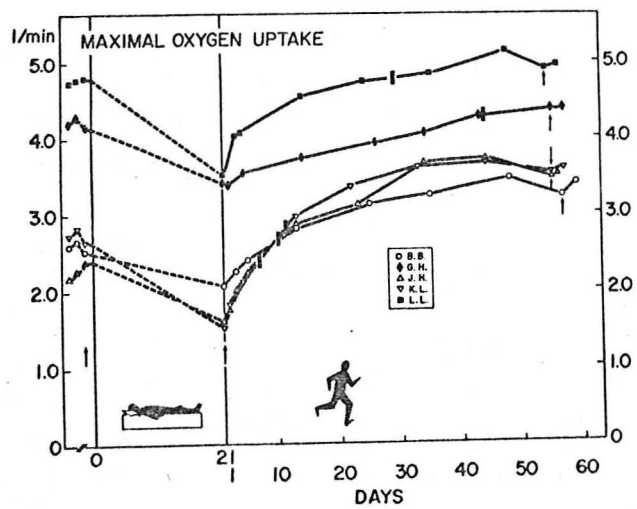
Physiological Effects of Bed Rest

The physiological effects of bed rest on the cardiovascular system are dramatic in terms of loss of cardiovascular fitness. These effects must be considered in the bed rest treatment of patients with myocardial infarction.

The cardiovascular effects of bed rest are best illustrated in the following study from Dallas by Drs. Saltin, Blomqvist, Mitchell, Johnson, Wildenthal, and Chapman.[13]

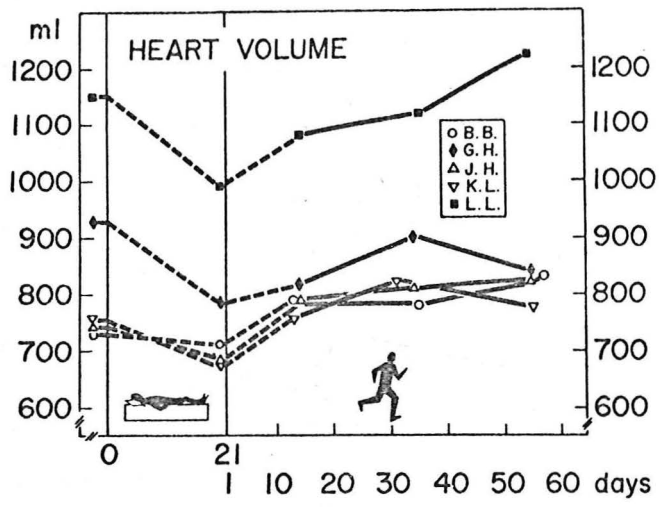
Five normal college student volunteers, two long distance runners and three sedentary, were placed at complete bed rest for 21 days. These normal subjects were maximally exercised on entrance to the study, at the end of 21 days of bed rest and then periodically following an intensive training program.

Maximal oxygen uptake, the measure of cardiovascular fitness, was measured on entrance to the study, when repeated after 21 days of bed rest. A dramatic decline in maximal O_2 uptake was seen, indicating a rapid loss of cardiovascular reserve from bed rest alone. The improvement in maximal oxygen uptake can be seen during the training program.



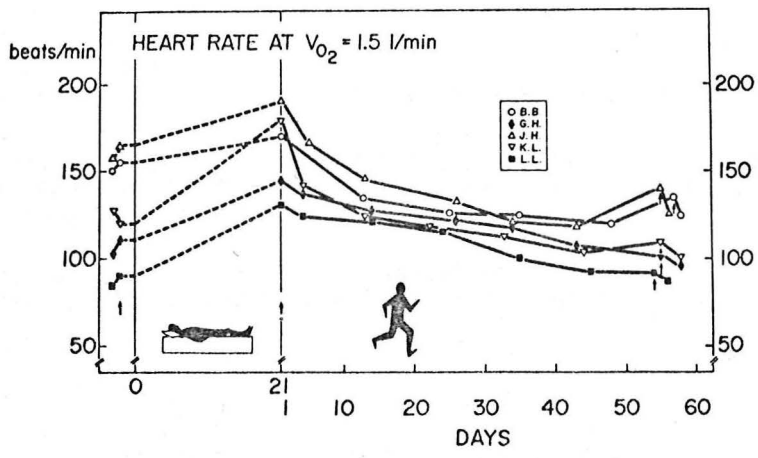
from Saltin et al

Heart volume from x-ray examination was also estimated and shown on this graph. A rapid and significant decrease in heart volume occurred suggesting a decrease in blood volume and filling pressures. The return in volume can be seen with training.



from Saltin et al

In the figure below one can see the changes in heart rate at a fixed work load (myocardial oxygen consumption of 1.5L/min) before and after bed rest. Heart rate significantly increased at this fixed work load after bed rest.



from Saltin et al

The mean circulatory data during maximal work before and after bed rest were:

	Before	After	% Change
Oxygen uptake L/m	3.30	2.43	-26.4
AV O_2 diff. vol %	16.5	16.4	- 0.6
C.O. L/m	20.0	14.8	-26.0
H.R.	193	197	+ 2.1
S.V. ml	104	74	-28.8

Importantly, this study in normal healthy subjects indicates that bed rest results in a rapid decrease in cardiovascular reserve, especially important in patients with coronary disease is the resultant increase in heart rate for any given work load which will result in increased myocardial oxygen consumption and possible ischemia.

The adverse effects of bed rest are summarized:

1) decrease in work capacity
2) increase in heart rate response
3) orthostasis
4) decrease in blood volume
5) decrease in lung volume
6) decrease in serum protein
7) negative nitrogen and calcium balance
8) decrease muscle strength

Early ambulation and exercise has been recently used to prevent not only these adverse effects but also to decrease theraputic complications.

Guidelines to early activity have been defined and are listed here. If any of these develop in a patient following a myocardial infarction then a less vigerous program is recommended:

Chest pain
Dyspnea
Heart rate above 110
ST-T abnormality
Significant arrhythmias
Systolic blood pressure decrease in excess of 20 mmHg.

13. Saltin, B; Blomqvist, G; Mitchell, J.H.; Johnson, R.L.; Wildenthal, K.; and Chapman, C., Response to Exercise After Bed Rest and After Training, Circulation, XXXVIII, No. 5, Supplement No. VII

14. Royston, G.R.: Short Stay Hospital Treatment and Rapid Rehabilitation of Cases of Myocardial Infarction in a District Hospital

Physician Practice in Patient Management

Criteria for management of acute myocardial infarction patients has changed significantly during the last decade, especially with respect to duration of bed rest and in hospital stay. The following series exemplify these changes in physician practice in the care of myocardial infarction patients.

Reference	Year	Recommendation for bed rest
Lewis[15]	1937	8 weeks bed rest
Levine[16]	1940	4-8 weeks in bed
Levine[17]	1951	4-8 weeks at rest
Levine and Lown[18]	1952	63 of 73 patients in chair by third day
White[19]	1945	1 month bed rest
Irvin and Burgess[20]	1950	2 weeks in bed
Brummer, Linko, and Kasanen[21]	1956	16 days bed rest
Brummer, Linko, and Kallio[22]	1961	12 days bed rest
Wood[23]	1960	3-6 weeks in bed
Wood[24]	1968	2 weeks in bed
Friedberg[25]	1966	2-3 weeks minimum bed rest
Lauper, Lichtlen, and Rossier[26]	1966	Armchair treatment beginning second week
Laland Caroli[27]	1968	Ninth day in chair
Naughton et al[28]	1969	Up for meals third day; up every 2 hours on fifth day
Takkunen[29]	1970	5 days bed rest
Harpur et al[30]	1971	7 days bed rest
Wenger[31]	1971	3-5 days bed rest
Royston[32]	1971	3-5 days bed rest
Acker[33]	1973	3-5 days bed rest

The most comprehensive recent survey of physician management of patients with myocardial infarction was published in 1973, a survey made of 3,600 physicians throughout the nation specifically designed to evaluate current physician practice in patient management of uncomplicated myocardial infarctions.[35] The following tables are data extracted from this report.

Management of Uncomplicated Myocardial Infarction 1970

Specialty	General Practice	Internal Medicine	Cardiology
Case load/year	900,000	740,000	60,000
Per cent	53%	44%	4%
CCU Use	80%	90%	91%
Number of days average	4.5	4.5	4.5
Intermediate Care			
Average number of days	6	6	6
Hospital days	21	21	21
Propholactic Anti-arrythmics	27%	19%	19%
Anticoagulants	71%	71%	71%
Exercise Testing	20%	12%	25%

from Wenger et al "Physician Practices"

Activity Progression 1970:[35]

Day 3	-	Feed themselves Bedside commode
Day 5	-	Self care in bed
Day 8	-	Sit in chair
Day 12	-	Bathroom privilege
Day 14	-	Walk in room
Day 17	-	Walk in corridor
Day 30	-	Climb stairs

from Wenger et al "Physician Practices

Counceling 1970:

Smoking	97%
Diet	97%
Return to work	98%
Physical activity	93%
Sexual activity	95%

from Wenger et al "Physician Practices"

Return to Work (less than 65 years old)

87% by 1 year

Return average	2 - 4 months
Lightwork	2 months average
Moderate work	3 months average
Heavy work	4 months average

from Wenger et al "Physician Practces"

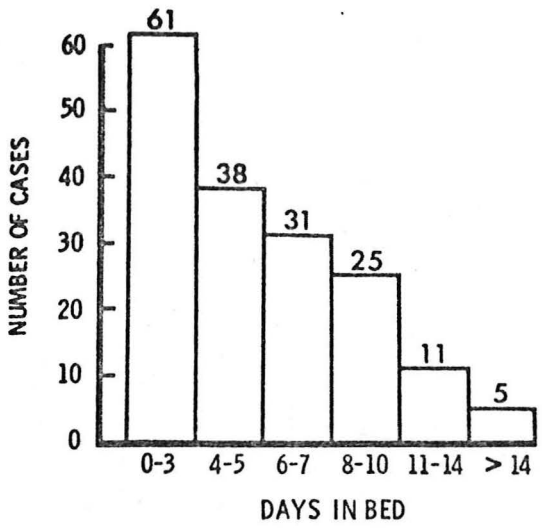
It is of interest to note that the majority of patients with myocardial infarction are managed by general practitioners and the overall management varies little in the hands of the general practitioner or internist or cardiologist.

Since this survey, six years ago, I would speculate that more patients are managed in CCU's, the activity level is accelerated, hospital stay is shortened, and anticoagulants are less frequently used. This speculation is based on small surveys since no comprehensive national survey is available.

"Early" Ambulation

Studies have shown that allowing patients with myocardial infarction out of bed early in the convalescence does not increase the immediate mortality rate or the incidence of cardiac aneurysm, myocardial rupture, congestive failure, or recurrent infarction. In spite of this many patients are still subjected to a traditional period of prolonged bed rest, the disadvantages of which are either not considered or are viewed as more acceptable. The benefits of early chair and ambulatory treatment in avoiding thromboembolism, in preventing "cardiovascular deconditioning", and in relieving anxiety, together with the absence of complications described above, would appear to out weigh concerns of the physician that for the most part seem unfounded. Royston[32] has reported two hundred consecutive patients with myocardial infarctions with early ambulation as part of their rehabilitation program with no increase in

morbidity or mortality. The bed rest time is illustrated in the figure below.



from Royston

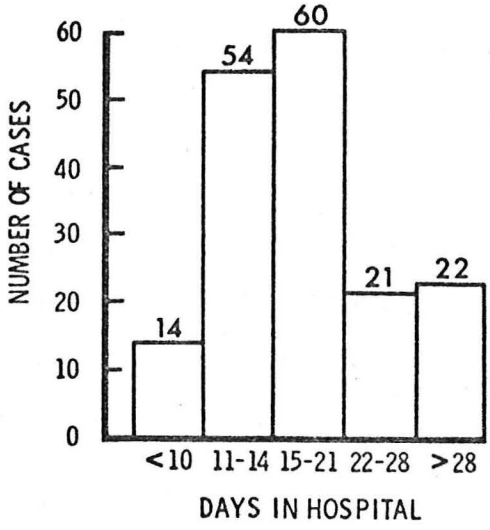
Each patient must, of necessity, be individualized as to his progression depending upon complications, age, and other medical problems. Therefore, staging programs have been developed which can be used for each patient with the rate of progression dependent upon the patient's response at each "stage". Included in the appendix are examples of staging programs with specific activity levels and specific orders that may be useful. The patient is considered eligible for the rehabilitation program when his clinical condition is stable and he has no evidence of complications of myocardial infarction, heart failure, shock persistent or recurrent chest pain or significant arrhythmias.

"Early"Discharge

Many well controlled series have been reported that clearly show that patients with uncomplicated myocardial infarction can be discharged within two to three weeks or even less. The earlier the discharge, if medically prudent, the greater the benefit to the patient in terms of 1) economics of hospitalization, 2) prevention of depression, 3) circumventing the adverse effects of deconditioning, and 4) earlier return to employment.

Lown and Sidel [38] have stated that patients who are without complications of an infarction during the initial week of hospitalization derive no special benefit by remaining in the hospital beyond the tenth to twelfth day. Adgey[39] has shown that in patients hospitalized for an average of 13.1 days there was no apparent morbidity in the two week period after discharge which might have been prevented by a longer hospital stay. Similarly, Pineas and Lovell[40] demonstrated that a decrease in the average hospital stay from over four weeks to three weeks or less was not accompanied by an increased mortality during the first three months after discharge,

Harpur et al(30) in a randomized study reported no differences in morbity or mortality with discharge at fifteen days versus twenty-eight days in uncomplicated patients with myocardial infarction. The early discharged patients often returned to work within one month. Royston(32) also reported a similar early discharge series in two hundred patients illustrated below.



from Royston

In fact, studies have been reported (but not recommended) that suggest uncomplicated myocardial infarction patients can be managed at home (after two hours following onset of symptoms) with no increased mortality when compared with hospital treated patients.(33,34)

This is not to imply that the duration of bed rest and hospitalization are to be dictated by a standardized modality of treatment. Earlier mobilization has been recommended for a minor acute illness, with longer bed rest for those with recurrent chest pain, a persistent third heart sound, cardiomegaly, pulmonary edema, arrhythmias, or a pronounced precordial pulsation.

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Exercise Testing

It is essential to assess cardiovascular performance at various stages in the recovery from coronary heart disease. Accurate assessment quantitates the degree of cardiac impairment and determines recommendations for future activity. At present, assessment of functional capacity is frequently limited to the history and to clinical observation of patients at rest. However, these methods often provide erroneous information with respect to objective measurement of physical performance in about 20% of ambulatory cardiac patients.(41)

Formal exercise testing is a necessity in evaluating most patients with uncomplicated myocardial infarction prior to their return to employment or other significant increases in activity level to quantitate their disability.

A treadmill or bicycle egometer is used and the patient attains a heart rate as high as he might encounter in his vocational or recreational activities to observe the occurance of arrhythmias, angina, or significant ischemic changes in his ECG monitor. If none of these untoward events occur, then a rational recommendation can be made to the patient to resume these increased levels of exertion.

It has been shown that the average work load (caloric expenditure) of an individual during work should probably not exceed one-third to one-half of his maximum working capacity, and that prescribed physical exercise should probably recommend an intensity of exercise between 60% and 80% of the individual maximal capacity.(42) Therefore, exercise stress testing should be carried out at least to these levels to assess performance limits so that work, recreational activities, or exercise may be prescribed rationally.

Despite the overwhelming scientific appeal to formally evaluate performance in the post infarct period, very little data is available for comparison or guidance and essentially no data is available in the early post infarction period. Yet this performance data is essential prior to a patient's resuming significant increases in exercise levels, which may be at time of hospital discharge, shortly thereafter, or certainly prior to return to his occupation or resumption of recreational activities or exercising. Asymptomatic ischemia may appear on the stress test ECG or latent arrhythmias may be detected which may harbenger sudden death and should be suppressed with drug therapy.

The use of exercise testing and halter monitoring are useful methods of evaluating late and latent arrhythmias in patients post myocardial infarction. A study has recently been completed at the Dallas V.A. Hospital by Drs. Crumbo, Ritter, Osborn, Shapiro and Smitherman(43) in 48 patients using submaximal exercise testing (H.R.120) and four hour holter monitoring to evaluate arrhythmias in these patients at approximately three weeks, six weeks, nine weeks and twelve weeks post myocardial infarction. Importantly, they found during the early studies (three weeks post M.I.) ventricular ectopy in 40% with laboratory exercise and 68% with holter monitoring. Significant(malignant) ventricular ectopy was present in 17% with exercise and 43% with holter monitoring. The combination of both holter and exercise yielded a higher detection of arrhythmias than either alone. Furthermore, ectopy was 1) a predictor of low exercise tolerance (Low VO_2), 2) a predictor of future ectopy at later testing times, 3) not a predictor of prior ventricular fibrillation during the patient's acute myocardial infarction.

This study gives credence to early testing of post myocardial infarction patients for therapeutic as well as prognostic reasons and certainly is important in the patient's later phase of rehabilitation.

Our group, Drs. Lewis, Wohl, Willerson, Mullins and Blomqvist(44) recently completed an exercise evaluation of patients following an acute myocardial infarction forty patients (35 men and 5 women) ranging from 35 to 66 years of age with a mean age of fifty-seven years. Ten patients had acute anterior, 19 had inferior and 11 had subendocardial myocardial infarctions.

Submaximal exercise test to a symptom limited targeted heart rate to 130 was accomplished one day prior to hospital discharge, usually three weeks post infarction. Follow-up studies were done at six weeks, three months, and six months after myocardial infarction. Indirect cardiac outputs were measured by the acetylene rebreathing technique.

CARDIAC OUTPUTS AT REST AND DURING BICYCLE EXERCISE (Mean ± S.E.)

Time	No. of Patients	Rest	Exercise
3 wks	34	3.5 ± .2 Lit/min	6.0 ± .4 Lit/min
6 wks	30	3.4 ± .2 Lit/min	5.6 ± .3 Lit/min
3 mos	17	3.2 ± .2 Lit/min	5.5 ± .5 Lit/min

The data on submaximal dynamic exercise is shown in this table. There were 22 patients who completed the three month study. At a submaximal work load of 300 kpm/min. There was a significant ($p<.001$) decrease in heart rate with mean values at three weeks of 126, at six weeks 120, and at three months 114. There was no significant difference in the blood pressure response or rate pressure product at this level from three weeks to six weeks to three months. At the initial study, at a rate-pressure product of 184, 11 patients or 50% had signs of myocardial ischemia; six has angina, 4 had ST segment changes; and one only had angina and malignant ventricular arrhythmias. At six weeks at the same work load, the rate-pressure product was not significantly different. However, signs or symptoms of myocardial ischemia were significantly less frequent with only two patients (9%) having ST segments displacement and no patient having angina or arrhythmias. ($p<.03$). An analysis of the 11 patients who developed ischemia signs at the initial test demonstrated that the rate-pressure product at the onset of ischemia was higher at six weeks and three months as compared to three weeks suggesting a higher angina threshold during followup studies. This suggests the occurence of either increased myocardial oxygen supply or a change in myocardial oxygen demand not accounted for by the rate pressure product, perhaps a decreased ventricular volume.

RESPONSE TO SUBMAXIMAL BICYCLE EXERCISE (300 kpm/min) IN 22 PATIENTS

		Blood Pressure			Signs of Myocardial Ischemia		
Follow-up Time	Heart Rate (beats/min)	Systolic (mmHg)	Diastolic (mmHg)	Double Product	Angina ST abn.	Arrhythmia	Total
3 wks	126±2	146±6	81±3	184±7	10 (45%)	1 (5%)	11 (50%)
6 wks	120±2	145±6	82±2	174±8	2 (9%)	0	2 (9%)
3 mos	114±3	146±6	82±2	168±9	3 (14%)	1 (5%)	4 (18%)

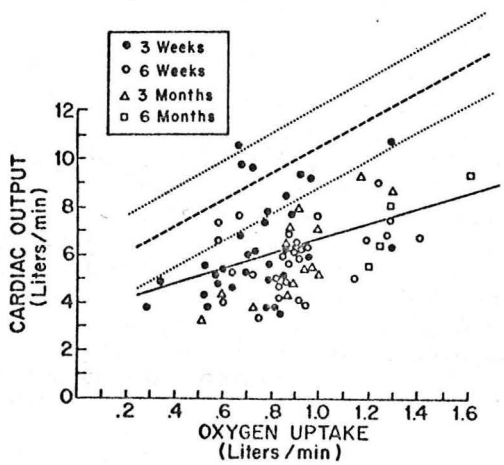
The data on maximal exercise testing at follow-up of six weeks and three months are summarized in this table. There was no significant difference in peak work load heart rate, or rate-pressure product from six weeks to three months post infarction. There was also no difference in the incidence of signs or symptoms of myocardial ischemia.

RESPONSE TO MAXIMAL BICYCLE EXERCISE IN 22 PATIENTS

Follow-up Time	Peak Work Lead kpm/min	Peak Heart Rate beats/min	Peak Blood Pressure		Double Product	Signs of Myocardial Ischemia		
			Systolic mmHg	Diastolic mmHg		Angina ST abn.	Arrhythmia	Total
6 wks	422±30	133±3	152±7	84±3	200±11	11 (50%)	5 (23%)	14 (64%)
3 mos	411±24	125±3	153±7	82±2	192±11	12 (55%)	3 (14%)	15 (68%)

Individual cardiac output data during upright bicycle exercise at three weeks, six weeks, three months and six months are given as a function of oxygen uptake on this slide. The range for normal middle aged men according to Mitchell et al(45) is indicated by the dashed line. Cardiac output in the patient group was markedly depressed and demonstrated no improvement from three weeks to six weeks to three months. There was a small but significant improvement in peak oxygen uptake during the early recovery phase of myocardial infarction occuring between three weeks and six weeks without further change up to three months. The improved work capacity and oxygen uptake during the early recovery phase of myocardial infarction without any change in cardiac output suggests a conditioning effect associated with improved distribution of peripheral blood flow and/or increased peripheral oxygen extraction rather than to recovery of cardiac function.

CARDIAC OUTPUT DURING BICYCLE EXERCISE



In summary, exercise tolerance testing aiming at symptom-limited maximal performance when accomplished under controlled circumstances with certain rules for discontinuing exercise is safe in the third week after acute myocardial infarction. Such exercise testing not only describes the patient's physical capacity and cardiovascular response to work at the time of discharge, but is also of psychological importance in encouraging the patient's return to useful life and is an important beginning to the later phase or rehabilitation.

A similar study has been completed at the Dallas V.A. Hospital by Drs. Ritter, Smitherman, Crumbo, and Shapiro in 47 patients post myocardial infarction. Their conclusions were:

Submaximal exercise at discharge after myocardial infarction, 1) was safe, 2) identified patients with late severe reduction in work capacity, 3) was 86% specific and 60% sensitive in predicting late angina, and, therefore, would provide an accurate guide to management after myocardial infarction.(46)

Perhaps, discharge submaximal exercise testing will become a standard in management of uncomplicated myocardial infarction patients for future rehabilitation programs.

Safety of Exercise Testing

In discussing exercise testing it is very important to consider safety. In ambulatory subjects, exercise testing has been shown to be relatively safe. In the study by Rochmis and Blackburn involving 170,00 exercise tests, there was a reported mortality of one in ten thousand, with the combined morbidity and mortality of four in ten thousand.(47) Although it would be expected that morbidity and mortality may be higher than this when dealing primarily with coronary heart disease patients, mortality is certainly much less than that for coronary arteriography or left heart catheterization.

It is necessary to have both resuscitation eqiupment and personnel trained in emergency resuscitation methods in an exercise test facility.

Summary:

Formal, low-intensity exercise testing may not only allow identification of treatable mechanisms of impairment, but it may also allow for determination of safely tolerated levels of activity. Observations during the exercise test may help in the selection of the less seriously ill and less incapacitated patients so that they may be permitted to progress more rapidly toward normal activity levels. At the same time, testing can identify the more seriously ill patient whose progress toward normal activity must be gradual and more carefully supervised. An additional potential benefit of early exercise testing is a reduction in the marked fear that physical activity may be harmful. This is a fear harbored by many patients recovering from myocardial infarction.

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Sexual Activity

Sexual activity, is in large part, an exercise and may be evaluated with the same physiological parameters of myocardial oxygen consumption as other exercise tests, namely the heart rate blood pressure product.

Hellerstein and Friedman(4) have evaluated sexual activity in the post coronary middle aged, long married male patient and found the physiologic costs small. They reported the following:

A study was made of the sexual activity of 91 middle-aged, middle-class (48 with arteriosclerotic heart disease, and 43 normal, but coronary prone) of comparable background, age and poor physical fitness. A subsample of 14 arteriosclerotic heart disease men was monitored by ECGs during work and sexual activity. The cardiovascular costs of conjugal sexual activity were relatively low compared to many other longer lasting daily living and ordinary work activities. The mean maximal heart rate during sexual activity corresponding to orgasm and ejaculation, was 117, range 90 to 144. The heart rate of the period encompassing the maximal heart rate (2 min. averaged 98. The O_2 uptake equivalent to the maximal heart rate and to the averaged heart rate were 16 and 12 ml O_2/kg/B.W./Min., and corresponded to 60 and 45% of the maximal O_2 uptake respectively.

This O_2 consumption corresponds to work loads of 6-8 cal/min, 600 kpm, 6 mets, climbing one to two flights of stairs, brisk walking, and is less than a masters two step.

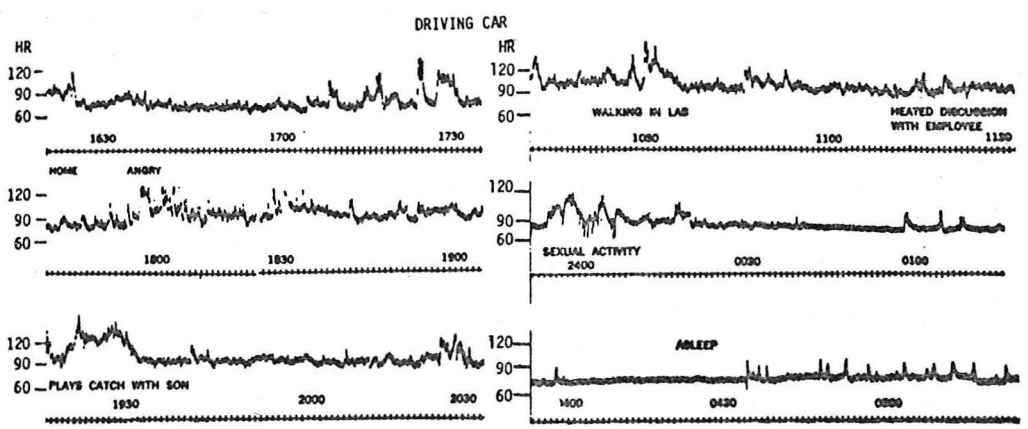
Blood pressure changes at comparable heart rates during exercise testing in the same group revealed a resting mean blood pressure of 127/85, a blood pressure of 163/89 at their maximum mean heart rate and a blood pressure of 145/88 at their average mean heart rate.

Changes in the EKG (STT depression and/or ectopic beats) during coitus and during regular occupational work were comparable in frequency (28%) and severity. The mean maximal heart rate during work was comparable to that during sexual activity.

Sexual activity decreased with age comparably in patients with arteriosclerotic heart disease and normals. In 58% of arteriosclerotic heart disease patients, it decreased further after the myocardial infarct. Sexual activity was resumed on an average of 14 weeks after the coronary event, occuring earlier in previously more sexually active subjects.

They concluded in view of the brevity of the duration, the low frequency, the modest heart rate and equivalent O_2 cost, and the symbolic importance of conjugal sexual intercourse, most middle-aged men with uncomplicated arteriosclerotic heart disease can resume this important activity.

An example of heart rate changes during a patient's daily activities from Hellerstein's group is seen below:



—Plot of heart rate obtained from 24-hour continuous ECG tape-recording of 44-year-old executive with ASHD and angina pectoris (patient 3).

from Hellerstein and Friedman

Approximately half post coronary patients resuming sexual activity report symptoms during intercourse, mostly awareness of a fast heart beat but a few report mild, usually non-limiting angina. This may result in fear and impotance. Impotance has been reported in 30% post myocardial infarction patients by Weiss(49) and in 10% by Tuttle(50), yet Hellerstein's group had none. Proper councelling and anti-anginal treament can alleviate the fear and angina and thus the impotance. Patients with angina should take Nitroglycerin just prior to intercourse and/or ejaculation or orgasm. In addition, propranolol maybe indicated to control heart rate. The combination of propranolol and nitrates should maintain a blood pressure heart rate product below the anginal threshold.

Impotance may also be related to antihypertensive therapy, tranquilizers, antidepressants, and associated diabetes.

Sudden death during intercourse has been reported, but is unusual in the average post myocardial infarct patient. Hellerstein and Friedman (48) reported: "In the experience of one busy coroner's office the pathologist estimated that sexual activity was associated with sudden death in approximately three of 500 subjects with arteriosclerotic heart disease (L. Adelson, M.D.). Recently in Japan, Ueno reported that so-called coition deaths accounted for 0.6% of endogenous sudden deaths (34 of 5,559 cases). Death was due to heart disease in half of the 34 cases and occurred most commonly during or after extramartial intercourse (80%).

Despite the lack of data to show that fatal heart disease is rarely precipitated by the resumption of conjugal sexual activity, a common fear exists, which may unduly influence the type of counsel rendered by the physician and the willingness of the patient and his spouse to forego this aspect of marriage."

In summary: at or about the 14th week of convalescence the patient's cardiovascular functional status can be estimated by 1) the historical approach from his ability to perform ordinary home and other activities of known energy costs, or 2) objectively measured by multilevel exercise tests of known or measured caloric costs. If the patient can perform exercise at levels of 6 to 8 calories/min (vigorous walking, Master 2-step test, 600 kpm/min on a bicycle ergometer) without symptoms or signs of an abnormal pulse rate, blood pressure or ECG changes, it is generally safe to recommend that he resume sexual activity and undertake most types of industrial employment. The wife and husband should be counceled together to alleviate both of their apprehensions.

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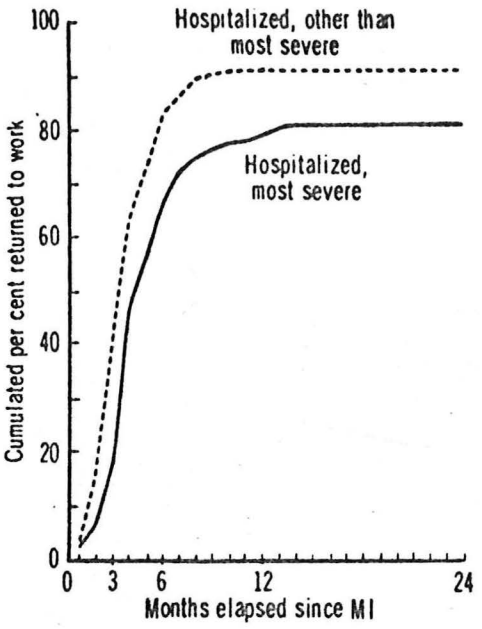
Return to Employment

Several surveys of return to employment following a myocardial infarction are listed in the table below:

Study	Percentage of patients unemployed after myocardial infarction
Levine and Phillips (55) California, 1944	26
Master et al (56) New York, 1954	28
Biorck (57) Malmo, Sweden, 1961	20
Malmcrona et al (58) Goteborg, Sweden, 1961	13
Biorck(59) Stockholm, 1964	17
Sharland (60) London, 1964	18
Wincott and Caird (61) Oxford, 1966	12
Sigler (62) New York, 1967	26
Groden (63) Glasgow, 1967	17
Wigle (64) Kingston, 1969	12
Hay (65) Christchurch, 1970	13
Shapiro (66) New York, 1972	21

Approximately 85% of patients with uncomplicated myocardial infarction eventually return to work while 25-35% of "complicated" myocardial infarction patients return to employment. The time of return to work is typified by the graph below.



from Shapiro et al

The recommendation is usually to return to employment at about three to four months post myocardial infarction, although little hard uncomplicated data exists to support this interval. Most patients can probably return to work at 8-10 weeks post M.I. if they do not do heavy labor. An exercise test to measure the patient's work capacity and then equating the patient's performance to known occupational work loads is certainly prudent as recommended.

The decision that the patient may return to work initiates a new and critical phase of rehabilitation. In the absence of work classification units or rehabilitation services, the principles of multidisciplinary approach can nevertheless be employed successfully by the private physician in most communities. Ideally a team should be used, consisting essentially of the private physician, industrial physician, employer (personnel manager of foreman), vocational counselor, and social worker. There individuals are united in an effort to match the patient's total capacity with the demands of the specific job.

Industrial job evaluation considers four aspects: 1) skill, 2) effort, 3) working conditions, and 4) responsibility. To the cardiac patient, effort and working conditions are of primary significance, although emotional

factors, which include reaction to responsibility, are also important.

The effort required by a great many of the possible occupations in America nowadays is surprisingly small and not significantly greater than that required by ordinary home activities. Little wonder that many cardiac patients prefer to work than to remain at home.

The table below gives a rough guide to the work loads expended by activity and occupation. This can be used in advising a patient after his exercise performance is evaluated.

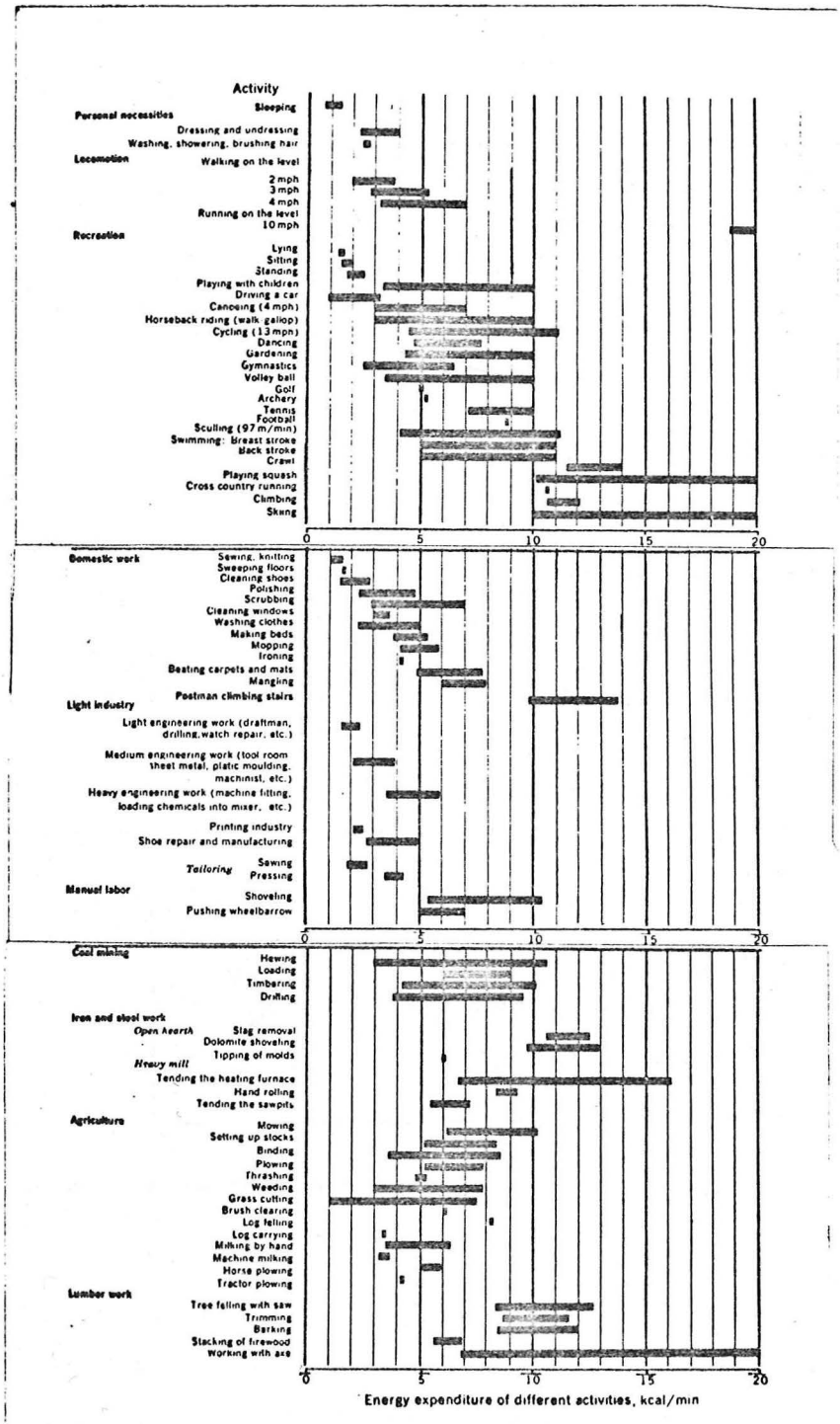
Approximate Metabolic Cost of Activities*

	Occupational	Recreational
1½–2 METs†	Desk work	Standing
4–7 ml O_2/min/kg	Auto driving‡	Walking (strolling 1.6 km or 1 mile/hr)
2–2½ kcal/min (70 kg person)	Typing	Flying,‡ motorcycling‡
	Electric calculating machine operation	Playing cards‡
		Sewing, knitting
2–3 METs	Auto repair	Level walking (3¼ km or 2 miles/hr)
7–11 ml O_2/min/kg	Radio, TV repair	Level bicycling (8 km or 5 miles/hr)
2½–4 kcal/min (70 kg person)	Janitorial work	Riding lawn mower
	Typing, manual	Billiards, bowling
	Bartending	Skeet,‡ shuffleboard
		Woodworking (light)
		Powerboat driving‡
		Golf (power cart)
		Canoeing (4 km or 2½ miles/hr)
		Horseback riding (walk)
		Playing piano and many musical instruments
3–4 METs	Brick laying, plastering	Walking (5 km or 3 miles/hr)
11–14 ml O_2/min/kg	Wheelbarrow (220 kg or 100 lb load)	Cycling (10 km or 6 miles/hr)
4–5 kcal/min (70 kg person)	Machine assembly	Horseshoe pitching
	Trailer-truck in traffic	Volleyball (6-man noncompetitive)
	Welding (moderate load)	Golf (pulling bag cart)
	Cleaning windows	Archery
		Sailing (handling small boat)
		Fly fishing (standing with waders)
		Horseback (sitting to trot)
		Badminton (social doubles)
		Pushing light power mower
		Energetic musician
4–5 METs	Painting, masonry	Walking (5½ km or 3½ miles/hr)
14–18 ml O_2/min/kg	Paperhanging	Cycling (13 km or 8 miles/hr)
5–6 kcal/min (70 kg person)	Light carpentry	Table tennis
		Golf (carrying clubs)
		Dancing (foxtrot)
		Badminton (singles)
		Tennis (doubles)
		Raking leaves
		Hoeing
		Many calisthenics
5–6 METs	Digging garden	Walking (6½ km or 4 miles/hr)
18–21 ml O_2/min/kg	Shoveling light earth	Cycling (16 km or 10 miles/hr)
6–7 kcal/min (70 kg person)		Canoeing (6½ km or 4 miles/hr)
		Horseback ("posting" to trot)
		Stream fishing (walking in light current in waders)
		Ice or roller skating (15 km or 9 miles/hr)
6–7 METs	Shoveling 10/min (22 kg or 10 lbs)	Walking (8 km or 5 miles/hr)
21–25 ml O_2/min/kg		Cycling (17½ km or 11 miles/hr)
7–8 kcal/min (70 kg person)		Badminton (competitive)
		Tennis (singles)
		Splitting wood
		Snow shoveling
		Hand lawn-mowing
		Folk (square) dancing
		Light downhill skiing
		Ski touring (4 km or 2½ miles/hr) (loose snow)
		Water skiing
7–8 METs	Digging ditches	Jogging (8 km or 5 miles/hr)
25–28 ml O_2/min/kg	Carrying 175 kg or 80 lbs	Cycling (19 km or 12 miles/hr)
8–10 kcal/min (70 kg person)	Sawing hardwood	Horseback (gallop)
		Vigorous downhill skiing
		Basketball
		Mountain climbing
		Ice hockey
		Canoeing (8 km or 5 miles/hr)
		Touch football
		Paddleball
8–9 METs	Shoveling 10/min (31 kg or 14 lbs)	Running (9 km or 5½ miles/hr)
28–32 ml O_2/min/kg		Cycling (21 km or 13 miles/hr)
10–11 kcal/min (70 kg person)		Ski touring (6½ km or 4 miles/hr) (loose snow)
		Squash racquets (social)
		Handball (social)
		Fencing
		Basketball (vigorous)
10 plus METs	Shoveling 10/min (35 kg or 16 lbs)	Running: 6 mph = 10 METs
32 plus ml O_2/min/kg		7 mph = 11½ METs
11 plus kcal/min (70 kg person)		8 mph = 13½ METs
		9 mph = 15 METs
		10 mph = 17 METs
		Ski touring (8+km or 5+miles/hr) (loose snow)
		Handball (competitive)
		Squash (competitive)

from Fox,
Naughton and Gorman

An additional useful work load table with ranges equated to occupation is the one from Astrand and Radahl(67).

1 kcal/min = 200 ml O_2 consumed/minute, 2.4 mets = 3 calories/min = 150 kpm/min

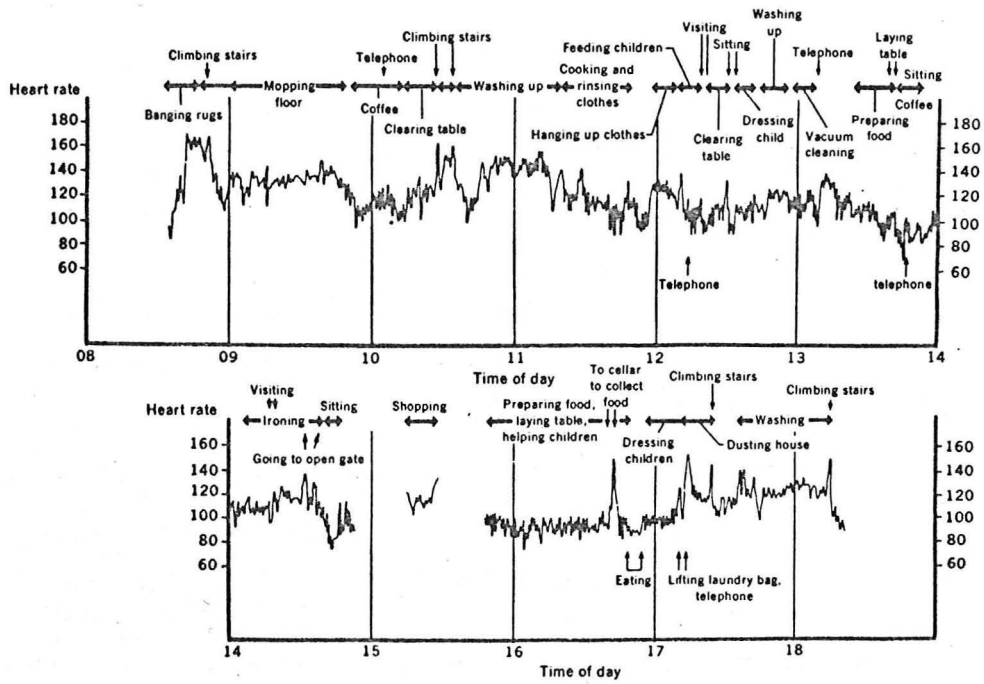


A complete listing of occupations with ratings for physical demands (work loads), working conditions, and training requirements can be obtained from the Department of Labor.

"Selected Characteristics of Occupations by Worker Traits and Physical Strength". 1968 Supplement 2 to the Directory of Occupational Titles 3rd Ed.

For sale by the Supt. of Documents, U.S. Goverment Printing Office, Washington, D.C. 20042 - $1.25.

Housework is extremely variable in energy expenditure depending upon the task undertaken. A typical heart rate response (which clinically is equated with work load) of a housewife during her usual activities is seen in the Figure below. No wonder angina may be frequent during household duties! Importantly, these heart rate increases can be attenuated with propranolol effectively and thus control angina. Also, it serves as a reminder of the work loads encountered by women at home and should assist in advising when to resume housework.



Heart rate in a housewife during an ordinary day of housework.

Hellerstein and Jones (68) have reported the energy expenditure limits for each cardiac classification group under the NYHA criteria.

Class I	=	4 - 6.6 cal/min	3-5 Mets
Class II	=	2.7 - 4.0 cal/min	2-4 Mets
Class III	=	<2.7 cal/min	<2 Mets

It has become evident that all but a few jobs requiring severe physical exertions (<6 calories/min, <5 Mets) may be suitable for the majority of cardiac patients. In fact, 75% of cardiac patients return to their former jobs following a recovery period after discharge from hospital. Therefore, "Cardiac Jobs" are usually not a necessity and are mostly a rehabilitation myth, except for those rare individuals employed in the very heaviest labor or those patients with severly compromised cardiac function.

The Texas State Rehabilitation Commission has as one of its functions the vocational rehabilitation of patients with physical disabilities. Patients who require occupational retraining due to limitation in their functional capacity post myocardial infarction can be referred to this agency for assistance. The patient will be referred to one of the local Dallas offices in their neighborhood for counceling.

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64. Wigle, R.D. et al: Return to Work After Myocardial Infarction, Can. Med. J. 104:210, 1971

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Automobile Driving

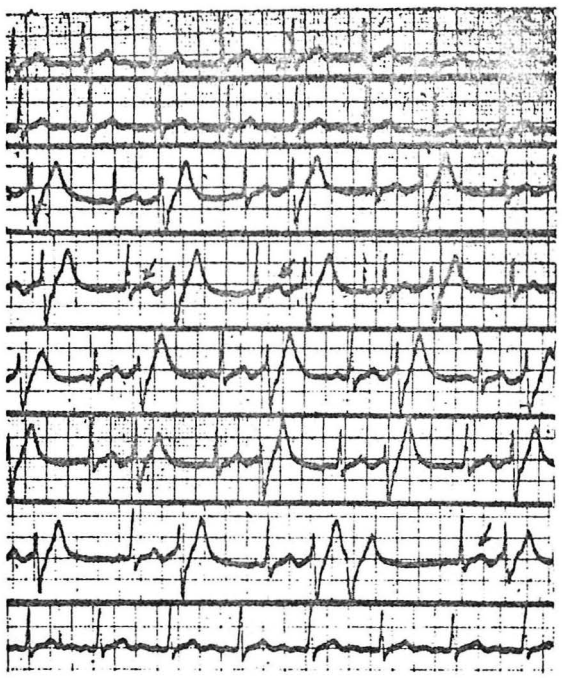
When should a post myocardial infarct patient return to automobile driving? Automobile driving, especially in heavy traffic is certainly a stress test, both physically and mentally, resulting in a physiological response of increased heart rate and blood pressure.

Two relavent studies have been reported. Taggart et al(67): "Electrocardiograms were recorded in experienced motor-car drivers accustomed to busy city traffic while driving their own cars along familiar routes. The majority (with normal hearts or a history of coronary heart disease) increased their heart rates; brief periods when the rate exceeded 140/min were recorded. ST changes not caused by tachycardia developed in 3 out of 32 "normal" drivers. Of 24 drivers with coronary heart disease 13 increased their ST and T abnormalities, the changes being gross in six, furthermore five developed multiple ventricular ectopic beats. Two coronary drivers experienced anginal pain and two left ventricular failure."

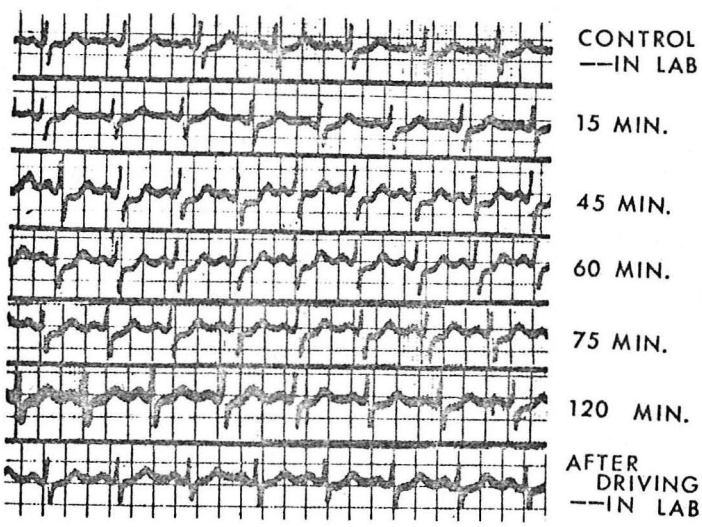
Bellet(68) reported: "The electrocardiogram was continuously recorded during a two and a half hour period of driving in 65 normal subjects and in 66 subjects with documented coronary heart disease. In normal subjects, except for a variable increase in heart rate, no significant changes were observed.

Among the subjects w ith coronary heart disease, significant electrocardiographic changes, i.e., ischemic type of S-T depression, multifocal premature contractions, ventricular bigeminal or trigeminal rhythm, were observed in 16.7 per cent. These changes occurred under relatively favorable driving conditions."

Two examples of ECG changes during driving are shown below from Bellet et al (68).



Ventricular bigeminy and trigeminy during driving in a man aged 44 years, with episodes of coronary insufficiency. The control (CR_6) shows a normal electrocardiogram. At 30 minutes note the appearance of coupled ventricular premature beats. At 45 minutes, note the continuation of the ectopic beats and a terminal downward dip of the T wave in the complex following the compensatory pause. Coupled beats continue until 120 minutes, when ventricular premature beats occur in sequences of two premature beats. At 150 minutes, upon cessation of driving, the electrocardiogram is normal.



Ischemic S-T depressions during driving in a man aged 56 years, with a history of frequent episodes of precordial and substernal pain. Note on the control (lead II) that the S-T segments and T waves are normal. Between 30 and 60 minutes of driving note the development of ischemic S-T segment depressions. These are less marked at 120 minutes and have returned practically to the control after the driving period.

from Bellet et al

Bellet et al(68) has summarized current data on traffic accidents caused by patients with coronary artery disease. "It is well known that episodes of acute coronary insufficiency may result in traffic accidents. Norman(69) found that a third of all cases of loss of consciousness while driving were caused by acute myocardial infarction and that in fifty per cent of these cases the drivers did not have enough time to stop the car. Trapnell and Groff(70) reviewed the clinical course of 35 truck drivers who had returned to work after a first myocardial infarction. Five of the drivers subsequently had second myocardial infarctions, four of which were sustained while driving. Hoffmann(71) found that among 31 subjects known to have suffered myocardial infarctions while driving 10 caused traffic accidents. West et al(72) reported on a series of single car accidents in California between 1963 and 1965; of 1,026 drivers who died within 15 minutes of their accident, 155 (15%) died of natural causes. Of these subjects, 134 died as a result of an acute coronary episode; many of them were unaware of their heart disease. These single car accidents represent only approximately 10% of the total fatal car accidents; it is probable that the sudden death of the driver due to coronary heart disease also caused other accidents involving multiple car collisions."

These findings are forboding for both the patient with coronary disease and the physician who must agree to a patient's return to driving.

There is no standard prescription, either medically or medicolegally. Most commerical trucking firms will not allow a driver to return to driving after a myocardial infarction or after coronary bypass surgery. Some states require a physician's approval for any patient to return to driving after a myocardial infarction.

A monitored formal exercise test seems appropriate prior to a patient's return to driving following a myocardial infarction (or with angina) and perhaps repeated yearly or with any change in clincial status. The findings of latent arrhythmias unmasked by exercise testing and low work load ischemic changes should be a contraindication to driving. Inclusive, should be any high risk patient, i.e. congestive heart failure, bradyarrythmia, aneurysms.

The use of propranolol to prevent arrythmias and to surpress the heart rate reponse to driving and thus ischemic changes should always be considered.

67: Taggart, P.: Gibbons, D.; and Somerville, W.: Some Effects of Motor-car Driving on the Normal and Abnormal Heart. Brit. Med. J., Oct. 1969

68. Bellet et al: Continuous Electrocardiographic Monitoring During Automobile Driving - Studies in Normal Subjects and Patients with Coronary Disease. Amer. J. of Cardiology 22:856, 1968

69. Norman. L.G.: Medical Aspects of Road Safety. Lancet, 1:1039, 1960

70. Trapnell, J.M. and Groff, H.D.: Myocardial Infarction in Commercial Drivers. J. Occup. Med. 5:182, 1963

71 Hoffmann, H.: Myocardial Infarct Behind the Steering Wheel. Munchen. med. Wchnschr., 105:1785, 1963

72. West, I; Gilmore, A.E.; Nielsen, G.L.; and Ryan, R.J.: Natural Death at the Wheel. JAMA 205:266, 1968

Heart Clubs

Previous studies(73,74,75) have confirmed the effectivness of group educational programs in reducing psychological morbidity in cardiac patients and their assistance in maintaining compliance in patients in exercise programs and in adherence to risk factor prevention programs.

Some of these groups are organized by patients themselves, and others by physicians and or other health delivery professionals. Most of these groups start with the patient in hospital and continue indefinitely after discharge. The patients are instructed on what they should and should not do in various situations, their questions are answered and informational materials are made available. The patient is encouraged to share his experiences with the group much as in a "group therapy" session.

The "Mended Hearts Club", Dallas Chapter is one such effective club. They meet the first Tuesday of each month at the Wadley Blood Center and will visit patients in hospitals if requested by the physician. Their phone number is 231-1523.

73. Rahe, R.H., et al. Group Therapy in the Outpatient Management of Post-Myocardial Infarction Patients. Psychiatry in Medicine, 4:77, 1973

74. Bilodeau, C.B. and Hackett, T.P.: Issues Raised in a Group Setting by Patients Recovering from Myocardial Infarction. Amer. J. Psychiat. 128:73, 1971

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Chronic Exercise Training Program

The extensive review of the use and results of chronic exercise training programs for post myocardial infarction patients is to extensive for this protocol and I would refer you to a comprehensive review of this subject by Dr. Jere Mitchell in his Parkland Memorial Hospital Grand Rounds on March 8, 1973, which have been published in Advances in Internal Medicine, Volume 20, page 249, 1975.

In brief, the physiological effect of a chronic training program in patients with coronary disease are:

1) Increased physical work capacity - an average increase of work capacity approaches 50%.
2) Decreased heart rate at rest and for any given submaximal work load. Thus:
3) Decreased myocardial oxygen requirement for any given submaximal work load: decreased heart rate - blood pressure product.
4) Decreased systolic blood pressure at rest and for any given submaximal work load.
5) Improved myocardial performance - debated but indirect indices suggest this in selected patients.
6) Psychological benefit - patients develop a feeling of well being and depression is prevented.
7) Some suggest an increase in collateral circulation, others show no change = unknown.
8) Longevity - controversial, but well developed studies (without patient selection bias) suggest little improvement. (76)

These programs are certainly not for every patient with post myocardial infarction or with angina. These activity programs are probably contraindicated in patients with cardiomeglia, congestive heart failure, low threshold angina, ventricular anerysms, and significant mitral regurgitation secondary to papillary muscle dysfunction.

To summarize I would quote Dr. Jere Mitchell's conclusions: "The precise role and effectiveness of exercise training in the treatment of coronary heart disease cannot be defined at the present time. The important question of whether or not longevity is increased by this mode of therapy has not been answered. Further there is no good data to show that exercise training, per se, has any retarding effect on the development of arteriosclerosis in the coronary vessels.

One important finding from studies on exercise training in patients with coronary heart disease is that both subjectively and objectively their physical work capacity can be significantly improved. For a patient who is content to live a physically inactive life exercise training is of little benefit unless it slows down the disease process and prolongs life. However, for a patient who wants to live a life of more normal physical activity with symptoms, such improvement in work capacity is extremely important. If exercise training is used critically

and is carefully supervised its beneficial effects seem more important than its possible harmful complications."(77)

In Dallas, the Dallas Cardiac Institute conducts an excellent, well supervised program at the Town North YMCA for cardiac patients and will accept patients on referral. Their phone number is 630-2806.

76. Wilhelmsen, L; Sanne, H.; Elmfeldt, D.; Grimby, G.; Tibblin, G.; and Wedel, H.: A Controlled Trial of Physical Training After Myocardial Infarction - Effects on Risk Factors, Nonfatal Reinfarction and Death, Preventive Medicine 4:491-508, 1975

77. Mitchell, J.H.: Exercise Training in the Treatment of Coronary Heart Disease, Advances in Internal Medicine, 20:249-272, 1975

78. Blackburn, H.: Disadvantages of Intensive Exercise Therapy After Myocardial Infarction, in Ingelfinger, F. (ed): Controversy in Internal Medicine, Vol. 2 Philadelphia: W.B. Saunders Co., 1974, pp. 162-172

79. Bruce, R.A.: The Venefits of Physical Training for Patients With Coronary Heart Disease, Ibid. pp. 145-161

80. Hirsch, E.Z., Hellerstein, H.K. and MacLeod, C.A.: Physical Training and Coronary Heart Disease, in Morse, R.E.(ed): Exercise and the Heart Springfield, Ill., Charles C. Thomas, 1972

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82. Holmberg, S.; Serzysko, W.; and Varnauskas, E.: Coronary Circulation During Heavy Exercise in Control Subjects and Patients with Coronary Heart Disease, Acta Med. Scand. 190:465, 1971

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85. Detry, J.M. and Bruce, R.A.: Effects of Physical Training on Exertional S-T Segment Depression in Coronary Heart Disease, Circulation 44:390, 1971

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The Problem: Rehabilitation

Coronary heart disease is a chronic disease with clinical manifestations in several million U.S. citizens, including two and a half million persons less than 65 years old. Over one-third of the individuals placed on the disability rolls of the Social Security Administration last year were placed there because of cardiovascular diseases. Most of these persons suffered from heart disease. The annual cost of heart disease disability and death in the United States was estimated at thirty billion dollars almost a decade ago. This figure underestimates the true magnitude of the problem since there is no realistic way to quantitate the wasted human potential which results from this disease.

Only a small fraction of those with chronic disability receive formal rehabilitation services. However, the fraction of those with cardiac disability receiving such services is disproportionately small. Thus, whereas 12% of the total disabled population received some type of formal rehabilitation assistance, only 6% of the 4.4 million cardiovascular disabled reported receiving such services. The fact that cardiovascular patients represent only a small fraction of the rehabilitation effort is further attested to by data from State Rehabilitation Services which in 1972 identified only 3.7% of their recipients as those with cardiovascular conditions - 2.4% with heart disease and 1.3% with other circulatory conditions.

Although there has been an increase in the total number of patients going through formal rehabilitation services, the number of cardiac rehabilitations is remaining essentially constant. For example, between 1968 and 1972 the Rehabilitation Services Administration noted that the annual number of cardiac rehabilitations remained essentially constant at about 7,300. Whereas this constituted 3.6% of the total rehabilitations in 1968, there has been a progressive drop to 2.3% of the total in 1972.

Those who received formal cardiovascular rehabilitation are not typical of the cardiac disabled in age or apparently in the type of cardiac disability. The recipients of formal rehabilitation for cardiovascular disease are relatively younger with an average age of 37.4 and include a substantital fraction of patients with rheumatic or congential heart disease in contrast to the typical cardiac disabled who is in advanced middle age and afflicted with coronary heart disease.

A preponderance of rehabilitation funding for heart clients seems to be for medical services in the more restricted sense rather than for comprehensive rehabilitation. For example, 95% of patients received "diagnostic procedures", 22% received "surgery and treatment", 16% received hospitalization, and only 37% received "training and training material".

Thus, formal rehabilitation services are utilized by only a small and atypical fracton of those with cardiovascular disability rather than

the typical middle aged person with coronary heart disease; whereas rehabilitation services in general have grown, the fraction going to the cardiac disabled has diminished.

Economics of Rehabilitation(87)

It is important to determine if rehabilitation is economically feasible. Do the results justify the expenditure of manpower and funds? Although the CCU increased the cost of acute care, it also effected a 5-15% increase in the survival of patients hospitalized for acute myocardial infarction. The increased costs of the later acute and convalescent care, i.e., rehabilitation programming, result in an improved quality of life for the survivors of acute myocardial infarction and in an increased ability to more rapidly return to work.

The rehabilitation approach is practical because in-hospital progressive physical activity programs can reduce the duration of hospitalization. It has been estimated that if the hsopital stay for each myocardial patient could be safely reduced by just one day, the annual saving in the cose of medical care in the United States would be at least $40 million.

The earnings of patients rehabilitated after AMI and the savings of the disability or pension funds not expended for them, far exceed the costs of rehabilitation services. In recent years, over 80% of cardiac patients referred to Work Evaluation Units or special rehabilitation centers were returned to work. The actual monetary value of their employment varied with their prior training and the availability of jobs. Rehabilitation programming is an economical mode of intervention and can be characterized as 'What's new after the CCU'."

If surveys are correct, 85% of patients under age 65 have returned to work within 2 to 4 months after an uncomplicated myocardial infarction, over 75% to their original jobs. Approximately 400,000 survivors of myocardial infarction are discharged from hospitals each year. If the figures cited are representative, the 15% of patients under age 65 who do not return to work constitute a significant number of individuals. They may have special needs for rehabilitation services, possibly because of increased impairment-physical, emotional or educational. Additionally, older patients, those not in the work force, may require special training to enhance function or to learn the work simplification techniques that will permit them to continue their independent living.

87. Report of the Task Force on Cardiovascular Rehabilitation of the National Heart and Lung Institute: Needs and Opportunities for Rehabilitating the Coronary Heart Disease Patient (To be published as DHEW Publication No. (NIH 75-750)

88. Wenger, N.K. et al: Uncomplicated Myocardial Infarction, JAMA 224: 511, 1973

89. Hay, D.R.: Rehabilitation After Myocardial Infarction and Acute Coronary Insufficiency. New Zealand Med. J., 71:267, 1970

90. Mulcahy, R. et al: The Rehabilitation of Patients with Coronary Heart Disease. Scand. J. Rehab. Med. 2: 108, 1970

91. Fisher, S.: Impact of Physical Disability of Vocational Activity: Work Status Following Myocardial Infarction. Scand. J. Rehab. Med. 2:65, 1970

Summary:

The rehabilitation program for the post myocardial infarction patient must be directed toward the restoration and maintainence of his optimal physiologic psychologic, social, educational and vocational status.

The rehabilitation program must, of necessity, be multidisciplined including not only the physician but many other health care professionals in hospital and in the community.

Education and information must be directed toward the patient, spouse, family and employer and should stress the alternatives available for the patient and his role in the family, job, society and recreational activity. These educational programs must include topics such as:

1). Definition and description of the disease process and its natural history and recovery therefrom
2). Information about coronary risk factors, vocational and family adjustments, and the psychological impact of heart disease
3). Exercise stress testing and training programs, work evaluation and cardiac rehabilitation units
4) Community resources for a) emergency and continuing emergency care, b) economic support, c) vocational rehabilitation, d) psychological counciling.

The rehabilitation process should begin immediately after myocardial infarction, or after onset of angina, or following coronary artery surgery and should be targeted toward an activity level compatible with the patient's degree of functional impairment.

Phases of rehabilitation can be arbitrarily divided into three subgroups 1) hospital care (CCU, intermediate care unit, and ward care), 2) convalescence (home) and 3)recovery (vocational).

In hospital:

Gradual, progressive, monitored "early" ambulation for selected patients, implemented by nurses, therapists, or other health professionals under the direction of a physician. Supervision and monitoring is necessary to ensure optimal safety and to document patient progress.

Early indentification of specific rehabilitation needs as warranted for selected patients. Although the major effort during hospitalization concerns acute medical care to ensure optimal outcome, the provision of counseling services and vocational and financial support is a prerequisit in some patients to ensuring a good outcome.

Education and counseling to prepare the patient and family for return to home and to job roles. Patient and family education coupled with counseling to meet specific patient needs, is a process which provides the patient and the family with the information required to achieve an improved long-term adjustment. It can be provided through the use of multimedia presentations and counseling rendered by non-physician health professionals, under physician direction. This education must be directed to such specific audiences classified according to educational level, ethnic and social class, and occupational group.

Convalescence:

Utilization of outreach services is mandatory, including the use of public health and visiting nurses to insure the continuity of patient care. Telephone follow-up service is recommended especially for those patients in whom there is concern either about the seriousness of their cardiac status or their ability to adhere to the prescribed care program.

Day care or other centers should be used to provide the patient and family an opportunity for continued counseling, supervised physical activity, and other appropriate services. Provision should be made for the establishment of supervised patient-family information and discussion groups, to meet on a regular basis to review status, concerns, and for receiving information considered important to rehabilitation.

Mended Hearts Club, Dallas Chapter Phone 231-1523.

Recovery:

Exercise stress testing should be used to provide a quantitative assessment of a patient's functional cardiovascular status. The results can be used to guide the patient in his vocational and recreational activities and to prescribe an appropriate regimen of physical training.

Regular, supervised exercise training should be used in selected patients to conteract the effects of physical deconditioning and to enhance functional capacity.

Secondary prevention programs should be stressed for coronary risk factor modification.

Cardiac rehabilitation or work classificiation units and job retraining units should be made an integral part of patient evaluation.

Texas State Rehabilitation Commission, Regional Office 13612 Midway Road, Dallas Texas Phone 387-8695.

The patient's psychosocial status should be appraised, and made an integral component of the assessment of rehabilitation potential. Appropriate

counseling services and personnel should be used for vocational, patient-family and employee-employer counseling.

Appendix

Activity Level Order Sheet

(St. Mary's Memorial Hospital, Knoxville, Tenn.)

Stage	*Level of Activity*	*METS* [1]	*Daily Living Activities*	*METS* [1]
I.	Complete bed rest	1	May turn self Watch TV & Radio Complete bath (when stable)	1 1
II.	Complete bed rest	1	May be shaved Feed self Lift onto bedside commode or bedpan (specify bedside commode or bedpan on doctor's orders)	1 1 3 4
III.	Complete bed rest	1	Read newspaper Wash face and hands and brush teeth	1 2 2
IV.	Dangle feet 5 minutes – T.I.D.	1	Shave self Make up face Comb hair Up on bedside commode	2 2 2 3
V.	Dangle feet 10 minutes – T.I.D.		Same	
VI.	In bedside chair 10 minutes – T.I.D.	1	Same	
VII.	Up in chair 15 minutes – T.I.D.	1	Begin partial bath	2
VIII.	Up in chair 15 minutes – Q.I.D. Walk 1-2 minutes in room each time up	1 2	Progressive bath Bathroom privileges if bathroom adjoining–if not, bathroom in wheelchair	2 2
IX.	Walk in hall 5 minutes each time up	2	Self-care Dressing, undressing, etc.	2
X.	Up ad lib	2	Same	

[1] METS – Metaholic Equivalent – one MET is the approximate energy expenditure while sitting quietly in a chair.

from Acker

Equicaloric matching–patient S.S. early convalescent period

Cardiologist allows (Cals/min)		Physiatrist matches (Cals/min)	
1.2	Sitting	1.2	Leather lacing
1.4	Eating	1.5	Passive exercise of extremities
1.4	Conversation on phone	1.7	Active exercise to upper limbs
2.5	Washing own hands and face	2.0	Active exercise to lower limbs
3.6	Walking 2.5 mph	3.6	Graded calisthenics to 3.6

Equicaloric matching–patient S.S. late convalescent period

Cardiologist allows (Cals/min)		Physiatrist matches (Cals/min)
3.6	Bedside commode	Weaving, overhead loom
3.6	Walking 2.5 mph	Graded calisthenics to 3.6 (to ex. #20)
4.2	Showering	Graded calisthenics to 4.2 (to ex. #25)
5.2	Walking downstairs	Conducting office business with secretary in hospital room

from Zohman

CARDIAC REHABILITATION ACTIVITY SCHEDULE

DALLAS V.A. HOSPITAL PROGRAM

Date and circle appropriate stage to increase activity; cross out any activity not desired.

_____ Stage 1: Day of chest pain: Evaluation
(Suggested Day 1 P.T. evaluation and planning)

_____
M.D. signature

_____ Stage 2: (Day 1 & 2) Bedside commode with pivot technique. Feed self. Read or write. Wash hands and face, brush teeth. Stand to weigh with pivot technique. Listen to radio. In bed activity: Passive and/or active assistance exercises to all joints as tolerated.

_____
M.D. signature

_____ Stage 3: (Day 3) Dangle at bedside 15 min. BID. Watch TV or listen to radio. Shave self. Diversional activities. In bed activity: Active exercises to all joints. Progression is made by new exercises and increasing repetitions. Altering patient body position during exercise may also be used. Continue all above activities.

_____
M.D. signature

_____ Stage 4: (Day 4) Chair with pivot technique 15 min. BID. Sitting activities: Exercises done of an active and/or mild resistive nature as tolerated. Continue all activities.

_____
M.D. signature

_____ Stage 5: (Day 5, 6, 7) Chair with pivot technique 30 min. TID. Bathe self at bedside. Sitting and standing exercises: rhythmic muscular activities and ambulation around room. Continue all above activities. May attend cardiac education classes in wheelchair.

_____
M.D. signature

_____ Stage 6: Chair 60 mins. QID. Walk back and forth in room 5 min. TID. Continued rhythmic activities and progressive
(Day 8, 9, 10) ambulation. Continue all above activities. May walk to cardiac education classes.

_____
M.D. signature

_____ Stage 7: Up in chair ad lib. Stand at sink and shave. Bathroom privileges. Walk in hall (on ward) 10 min. TID.
(Day 11,12) Intensification of exercise activity, begin stair climbing. Continue all above exercises.

_____
M.D. signature

_____ Stage 8: Bathe or shower in tub, dressing and walk in halls (on ward) 15 min. Intensified exercise and stair climbing
(Day 13,14) activities. Continue all above activities.

_____
M.D. signature

CARDIAC REHABILITATION DISCHARGE TEACHING

(Initiate Orders When Transferred to Ward)

1. Begin Cardiac Education classes when activity permits.
2. Place patient on a (4-6-8-10-12)week schedule after discharge.
3. Teach patient and family about a low cholesterol, low fat diet or

_____.

Activity	Mets	Activity	Mets
Recreational Activities			
Golfing	4	Jogging (5 mph)	8
Swimming, 20 yd./min	4	Cycling (12 mph)	8
Archery	4	Horseback (gallop)	8
Sailing -small boat	4	Vigorous downhill skiing	8
Fly fishing - standing	4	Basketball	8
Badminton - doubles	4	Mountain climbing	8
Pushing light power mower	4	Ice hockey	8
Energetic musician	4	Canoeing (5mph)	8
Dancing - foxtrot	5	Touch football	8
Gardening	5	Paddleball	8
Table tennis	5	Running (5 mph)	9
Raking leaves	5	Cycling (13 mph)	9
Tennis-doubles	5	Ski touring (4 mph) (loose snow)	9
Hoeing	5	Squash racquets (social)	9
Sexual relations - (conjugal	5	Handball (social)	9
Stream Fishing - walking in waders	6	Fencing	9
Trotting horse	6.5	Basketball (vigorous)	9
Ice of roller skating	7	Running: 6 mph	10
Badmitnton - competitive	7	7 mph	11½
Tennis singles	7	8 mph	13½
Splitting wood	7	9 mph	15
Snow shoveling	7	10 mph	17
Hand lawn mowing	7	Ski touring (5+ mph) (loose snow)	10+
Water skiing	7	Handball (competitive)	10+
Folk (square) dancing	7	Squash (competitive)	10+
Light downhill skiing	7		
Ski touring (2½ mph) (loose snow)	7		

Karen Wiggans - Presbyterian Hospital, Dallas, Texas

APPROXIMATE METABOLIC COST OF ACTIVITIES*

Self-Care

Activity	Mets
Rest, supine	1
Sitting	1
Standing, relaxed	1
Eating	1
Conversation	1
Dressing, undressing	2
Washing hands, face	2
Bedside commode	3
Walking, 2.5 mph	3
Showering	3.5
Using bedpan	4
Walking downstairs	4.5
Walking, 3.5 mph	5.5
Propulsion, wheelchair	2
Ambulation, braces and crutches	6.5

Housework

Activity	Mets
Hand sewing	1
Sweeping floor	1/5
Machine sewing	1/5
Polishing furniture	2
Peeling potatoes	2.5
Scrubbing, standing	2.5
Washing small clothes	2.5
Kneading dough	2.5
Scrubbing floors	3
Cleaning windows	3
Making beds	3
Ironing, standing	3.5
Mopping	3.5
Wringing by hand	3.5
Hanging wash	3.5
Beating carpets	4

Occupational Activities

Activity	Mets
Watch repairing	1.5
Armature winding	2
Cobbling	2.5
Typing	2.5
Bartending	2.5
Radio assembly	2.5
Sewing at machine	2.5
Welding - moderate load	2.5
Bricklaying	3.5
Plastering	3.5
Tractor ploughing	3.5
Wheelbarrowing 115 lbs. 2.5 mph	4
Painting Masonry	5
Paperhanging	5
Horse ploughing	5

Activity	Mets
Carpentry	5
Binding sheaves	5.5
Shoveling light earth	6
Mowing lawn by hand	6.5
Felling tree	6.5
Shoveling 10/min (10 lbs)	7
Ascending stairs - 17 lb. load 27'/min	7.5
Planing	7.5
Digging ditches	8
Carrying 80 lbs.	8
Tending furnace	8.5
Shoveling 10/min (14 lbs.)	9
Shoveling 10/min (16 lbs.)	10+
Ascending stairs - 22 lb. load 54'/min.	13.5

Recreational Activities

Activity	Mets
Playing cards	1.5
Painting, sitting	1.5
Playing piano	2
Driving car	2
Riding lawnmower	2.5
Canoeing, 2.5 mph	2.5
Horseback riding, slow	2.5
Volleyball	2.5
Flying	3

Activity	Mets
Motorcycling	3
Billiards	3
Sheet	3
Shuffleboard	3
Light woodworking	3
Powerboat driving	3
Bowling	3
Cycling, 5.5 mph	3.5
Rowing - leisurely	4

TAKING CARE OF YOURSELF AT HOME

Cardiac Patient Guidelines for Home Care

Dallas V.A. Hospital
and
Parkland Memorial Hospital

The following information has been prepared as a guideline in helping you take care of your heart at home. When you return home, continue to be as active as you were on the last day in the hospital. Remeber your heart is a muscle and it must be exercised to stay healthy. Your activity program, therefore, should be DAILY, and you should build up SLOWLY and GRADUALLY. Be honest with yourself when you evaluate your progress with your activity program. It is important that you do not do too much or too little. NEVER push yourself in any of the following activities so that you develop chest pain, shortness of breath, fatigue, or a fast pulse rate above 115.

GENERAL ACTIVITIES DURING THE _____ _____WEEKS AT HOME:

1. Eat 3-4 meals a day: Each meal should contain about the same amount of food. Avoid eating large meals which may put additional strain on your heart. Eat slowly and don't rush. (It is a good idea to take a rest period after eating. Do not plan activities or exercises directly after eating.) If you are trying to lose weight, set your goal at ½ to 1½ pounds off per week. Losing excess fat will decrease your chance of having another heart attack. Avoid crash diets.

2. Try to avoid situations, people and topics of conversations which upset you or make you tense and angry. Your heart works harder when you are upset.

3. Walking is a very important part of your exercise program. Plan where you will walk before you go. Avoid steps and hills because they make your heart work harder than walking on the level ground. Increasing your walking distance is also important. It may be helpful to clock out your distance in a car before planning to walk. Avoid walking outside in very warm or cold weather. In the summertime, plan your outside activity in the morning and evening when it is cool. The heat makes the heart work harder. During the winter, schedule your activities outside in the late morning or early afternoon during the warm part of the day. Walk after a rest period or when you're not already tired from another activity. If you should develop chest discomfort or shortness of breath, stop and sit down on the steps or curb, place a nitroglycerin tablet under your tongue (if the doctor has ordered it for you) and wait until you feel OK before you start walking again.

4. Plan your days and weeks activities. Space your activities during the day so that you do not do them all at one time. Do some of your acitvities in the morning, come in the afternoon and some in the evening, taking a rest period in between. Spread out your tasks by alternatin an easy one with a hard one. Try not to hurry. Plan your day so that you can get everything done without getting tense or hurried. Don't feel that you must rush to complete a job in a short time.

5. Plan a 20-30 minute rest period at least twice a day during the morning and again in the afternoon. It is not important to go to bed, but be sure to set aside the time to relax.

6. Every night, try to get 6-8 hours of sleep. Do not stay up very late one night, and "catch up" the next. If you must stay up late one night, take a nap beforehand.

7. Working with your arms above your shoulders is harder on your heart than working with them below shoulder level. Have someone rearrange your drawers and cabinets so the things you use often are at or below waist level. Avoid washing windows, hanging clothes on the line, and reaching for things above shoulder level.

8. Stop smoking cigarettes. Smoking is bad for your heart and lungs. Smoking cigarettes increases your chance of having another heart attack.

9. Regular coffee with caffeine will increase the heart rate. One to two cups per day is alright, unless your doctor states otherwise. Sanka is good to use if you want to dring more than one to two cups.

10. Continue to increase your walking and your activities gradually throughout the weeks. You should be back to all normal activities by the end of the _____week.

11. You may have _____ounces of liquor a day. Never drink enough liquor, beer or wine to make you drunk.

12. Check with your doctor before you take a long trip. When you go, stop every five hours and walk around in order to promote circulation in your legs. Check with your doctor before going to the mountains or to a place where it is very hot or humid.

13. You may begin sexual relations the _____week after discharge. As with other activities or exercises, you should not have sex if:

    a. you are fatigued or tired
    b. you have just eaten a heavy meal
    c. you have been drinking
    d. you are angry with your mate
    e. the temperature of the room is uncomfortably hot or cold. If you begin to have chest discomfort during sexual activity - STOP. The next time taking a nitroglycerin tablet before having sexual relations. Remeber it is normal for your heart to beat faster and your breathing to speed up during sexual activities. Your heart rate and breathing should slow down and return to normal shortly afterward.

14. If you get tired, no matter what you are doing, stop and rest for 15-30 minutes.

15. Avoid unusual tensing or straining such as:

    a. straining when having a bowel movement (ask your doctor about a laxative)
    b. lifting anything heavy such as children, groceries or suitcases
    c. pushing or pulling anything heavy
    d. trying to open a stuck window or jar lid.

16. Avoid the following activities during the _____ _____weeks home:

    a. heavy cleaning such as vacuuming, sweeping, mopping
    b. lift weights or do other isometrics
    c. rake leaves or hoe
    d. wash car
    e. play golf or tennis
    f. play basket ball or football
    g. ride a bike
    h. go bowling.

17. Go to the nearest emergency room if you have:

    a. chest pain which is not relieved in 30 minutes after resting and/or taking 2 nitroglycerin tablets.
    b. pain that is more severe than usual and is accompanied by sweating, nausea, vomiting, shortness of breath, fainting or a very slow or fast and skipping heart beat.

    Remember the decision to obtain help should not be left up to the patient alone. It is also the responsibility of the spouse, relative or friend.

DIET

Low Cholesterol - Low Fat Diet

To control your intake of cholesterol-rich foods:

(1) Eat no more than three egg yolks a week, including eggs used in cooking.
(2) Limit your use of shellfish and organ meats.

To control the amount and type of fat you eat:

(1) In most of your meat meals for the week, use fish, chicken, turkey, and veal.
(2) Limit beef, lamb, pork, and ham to <u>five</u> moderate-sized portions per week.
(3) Choose lean cuts of meat, trim visible fat, and discard the fat that cooks out of the meat.
(4) Avoid deep fat frying; use cooking methods that help to remove fat - baking, boiling, broiling, roasting, stewing.
(5) Restrict your use of fatty "luncheon" and "variety" meats like sausage and salami.
(6) Instead of butter and other cooking fats that are solid or completely hydrogenated (hardened), use liquid vegetable oils and margarines that are rich in polyunsaturated fats.
(7) Instead of whole milk and cheeses made from whole milk and cream, use <u>skimmed</u> milk and skimmed milk cheeses.

Serving Sizes

1. Meat, Poultry, Fish, Dried Beans and Peas, Nuts, Eggs
   1 serving = 3-4 ounces
   Use two or more servings daily to tal 6-8 ounces.

2. Vegetables and Fruits (fresh, frozen or canned)
   1 serving = 1/2 cup
   Use 4 servings daily, limiting your use of corn, potatoes, and lima beans.

3. Breads and Cereals (whole grain, enriched, or restored)
   1 serving of bread = 1 slice
   1 serving of cereal = 1/2 cup, cooked
   1 cup, cold with skimmed milk
   Use 4 servings daily and avoid butter rolls, commercial biscuits, muffins, doughnuts, sweet rolls, cakes, crackers, egg bread, cheese bread, commerical mixes containing dried eggs and whole milk.

4. Milk Products
   1 serving = 8 ounces
   Use 2 servings daily. Buy only skimmed milk that has been fortified with Vitamins A and D. Avoid chocolate milk, canned whole milk, ice cream, all creams including sour, half and half, whipped, whole milk yogurt.

5. Fats and Oils (Polyunsaturated)
   Use 2-4 tablespoons daily.
   Use margarines, liquid oil shortenings, salad dressings, and mayonnaise containing any of these polyunsaturated vegetable oils: corn oil, cottonseed oil, safflower oil, sesame seed oil, soybean oil, sunflower seed oil.

6. Desserts, Beverages, Snacks, Condiments
   Low calorie or no calorie:
   Fresh fruit and fruit canned without sugar, tea, coffee (no cream), gelatin, fruit whip, puddings made with non-fat milk, low calorie drinks, vinegar, mustand, ketchup, herbs, spices.
   Moderation should be observed in use of alcholic drinks, ice milk, sherbet, sweets and bottled drinks.
   Regular coffee with caffeine will increase the heart rate.
   One to two cups per day is alright unless your doctor states otherwise. Sanka is good to use if you want to drink more than one to two cups.

ACTIVITY SCHEDULE

____WEEK HOME:

Get up and get dressed every day
Sit up most of the day
Walk around the house
Take shower, bath or wash hair
Ride in car (not drive)
Get 6-8 hours sleep (including 1-2 rest periods)
Walk outside the length of a driveway twice a day
Play cards, checkers, light sewing, knitting or any sitting games as long as you do not get tense or excited.

____WEEK HOME:

Walk 1/2 block and back two times a day
Visit with your friends as long as they don't tire you
Cook one meal/day
Make out grocery list

____WEEK HOME:

Walk 1 block and back twice a day
Wash dishes and clean up after meal
Tidy up the bed, but do not change sheets
Wash clothes (put them in washer, but have someone else pull them out and carry them)
Go to grocery store and shop, have someone drive and carry home packages

____WEEK HOME:

Walk 2 blocks and back twice a day
Return to work 1/2 day (3-4 hours per day)
Resume sexual activities
Drive car
Go to church
Light grocery shopping (do not carry heavy packages)

____WEEK HOME:

Walk 3 blocks and back twice a day (total 1 mile)

____WEEK HOME:

Walk 4 blocks and back twice a day
Return to work full time
Yardwork

____WEEK HOME:

Walk 5 blocks and back twice a day

_____WEEK HOME:

Walk 6 blocks and back twice a day (2 miles total)
Resume social activities such as hobbies, fishing, dining out, parties, movies, ball games, travel, vacations, shoot pool.

CORONARY GENERAL INFORMATION SHEET

1. Any of the following symptoms are an indication that you may be progressing your activity too rapidly and should slow down:

a. Chest pain or discomfort during activity or following activity whether physical or emotional.
b. Palpitations, skipping or pounding heart during or following activity whether physical or emotional
c. Shortness of breath
d. A pulse rate of 120 or higher at any time the first 4 weeks after your discharge
e. A feeling of unusual fatigue at any time during the day or at the end of the day.

2. Any of the following symptoms should prompt you to seek immediate medical attention by either contacting your local doctor or going to the nearest emergency room:

a. Chest pain or discomfort which is not relieved by rest, or if you take Nitroglycerin, not relieved by rest and up to 4 Nitroglycerin tablets taken as instructed on Nitroglycerin medication sheet.
b. An unexplained fainting or blackout spell.

3. If you have any of the following symptoms for 24-48 hours, contact your local physician:

a. Beginning to experience shortness of breath or an increase in the degree of shortness of breath
b. Waking at night and finding it difficult to catch your breath
c. Noticing that you want to sleep on more pillows than before
d. Palpitations or pounding heart (being aware of your heart beating in your chest)
e. An unexplained episode of weakness and sweating, or cough
f. Any change in your anginal pattern (the way your chest pain occurs). You should report, for example, stronger attacks, attacks that occur at night or at rest, more painful attacks, increased frequency of attacks, and longer duration of attacks.
g. A sudden weight gain of 2 lbs. or more in one day or if your ankles or fingers become swollen