Cardiovascular Conference of Howard University and Freedmen's Hospital*

The Clinical Management of Acute Myocardial Infarction

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Editor's Note

The *Journal* wishes to announce the institution of a new "regular" feature beginning with this issue, "The Cardiovascular Conference of Howard University and Freedmen's Hospital."

These Conferences were initiated four years ago by Dr. John B. Johnson, director of the Cardiovascular Laboratory at Freedmen's Hospital. During the past two years these Conferences have been sponsored by the Cardiovascular Committee of Howard University and Freedmen's Hospital, under whose auspices they are now being published.

The Conferences are a voluntary activity attended widely by medical students, internes, residents, teaching staff, nurses and local physicians in general practice. The consistently high quality of these Conferences from both an academic as well as a practical point of view for the physician in practice has prompted some of the attending physicians to request that they be made available more generally.

It is quite probable that the readers will find in these Conference-reports a practical way of keeping current with many of the newer developments in cardiovascular diagnosis and therapy including cardiovascular surgery.

ACUTE myocardial infarction is a catastrophic injury to the heart due to prolonged severe localized myocardial ischemia. This ischemia results in local myocardial irritability, injury, and necrosis of heart muscle. It is frequently characterized clinically by rapid onset of severe precordial pain, vomiting and sweating, shock or symptoms of heart failure. This condition is almost invariably associated with coronary atherosclerosis. It occurs more commonly in men than in women, and in women myocardial infarction seems to occur uncommonly except in association with hypertension.

PATHOLOGICAL MECHANISMS

The pathological mechanisms in acute myocardial infarction are well known, and can be summarized as follows:[1, 2]

A. Local occlusion of a segment of coronary artery as a result of:
   1. Rupture of vaso-vasorum within the wall of a coronary artery producing hematoma and occlusion, bruised intima and local thrombosis, or rupture into the coronary arterial lumen and thrombosis.
   2. Atherosclerosis with ulcerated intimal placque formation and local thrombosis.
   3. Atherosclerosis with cholesterol abscess, ulceration, and thrombosis.

B. In the presence of coronary arteriosclerosis, cyanosis and shock from surgical anesthesia or blood loss from severe injury may result in sufficient segmental ischemia to produce local myocardial necrosis.

   This latter mechanism with reference to shock is at times not appreciated by the surgeon and the anesthetist during major surgical operations. Every effort should be made to avoid hypotensive episodes in the operating room. This is especially true of the older patient with atherosclerosis in whom acute myocardial infarction may readily be precipitated by shock.

THE DIAGNOSIS OF ACUTE MYOCARDIAL INFARCTION

The sudden onset of coronary thrombosis, the fact that it occurs commonly in the middle aged man at a very productive period of life, and the fact that in certain cases the mortality may be as high as 80 per cent make it mandatory that every physician be reasonably familiar with the diagnosis and immediate management of the acute attack of myocardial infarction.[3]

In the so-called typical case, the clinical signs and symptoms would be readily recognized by most

* We are pleased to acknowledge the able assistance of Rose Mary Collins in the preparation of the manuscript, of Thelma Blakey for the illustration and of Mary S. Brooks for stenographic assistance.

physicians. In actual practice, however, the onset of acute myocardial infarction presents a widely variable clinical picture.

Nevertheless certain clinical features tend to dominate groups of cases. A familiarity with these dominant clinical features will usually be adequate to alert the physician sufficiently to make use of the two laboratory procedures (vide infra) which, in addition to the clinical history, should assure accurate diagnosis in almost all cases of acute myocardial infarction. The three important elements in the diagnosis of acute myocardial infarction are: 1) clinical signs and symptoms, 2) electrocardiogram and 3) the serum transaminase concentration.

DOMINANT CLINICAL SIGNS AND SYMPTOMS

Patients with acute myocardial infarction will usually be found to fall in one or more of the following groups:

A. Sudden onset of precordial pain with or without radiation to arms and neck
B. Development of hypotension and shock
C. Acute pulmonary edema and left ventricular failure
D. Rapidly progressive increase of heart failure
E. Sudden onset of cardiac arrhythmia
F. Unexplained peripheral or pulmonary emboli
G. Occasional atypical case in which diagnosis clinically unsuspected but discovered by routine electrocardiogram
H. Cases with acute gastro-intestinal symptoms.

THE ELECTROCARDIOGRAM IN ACUTE MYOCARDIAL INFARCTION

The electrocardiogram is the single most important laboratory aid in the clinical diagnosis of acute myocardial infarction. In most cases the localized area of necrosis with its contiguous zones of injury and ischemia of cardiac muscle results in characteristic deformations in the electrocardiographic pattern which are especially well demonstrated in the unipolar precordial leads of the electrocardiogram.

The characteristic features of the effect of transmural myocardial electrocardiogram is illustrated in Fig. 1 showing the zones of necrosis, injury and ischemia.

The exploring electrode at position "A" faces

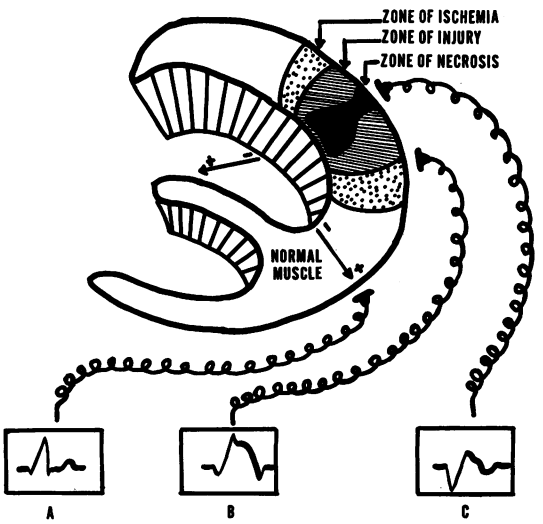

Fig. 1—Diagramatic representation of electrocardiographic changes following acute transmural myocardial infarction. Note characteristic effects of zones of ischemia, injury and necrosis on the Q,R,S complex of the electrocardiogram.

the positive end of the resultant electrical vector, giving a positive major deflection, the "R" wave. At position "C", the exploring electrode on the other hand faces an "electrical window", necrotic muscle, in the ventricular wall. In this instance the electrical vector giving rise to the QS wave and absent "R" wave which is characteristic of the acute transmural infarct.

In some cases the single electrocardiogram may not be sufficiently definite to confirm the clinical impression of acute myocardial infarction but daily tracings often demonstrate rapid evolutionary changes in the "ST" and "T" waves of the electrocardiogram as to confirm the clinical diagnosis. There are not infrequent instances in which the diagnosis is not certain electrocardiographically even after serial tracings. This problem arises in some cases in which a left bundle branch block was known to have been present prior to the infarction in question, or in cases where the electrocardiogram was already so abnormal that the configuration was not significantly altered by the new myocardial infarction. Figure 2 shows serial electrocardiograms from the first day of attack in a physician who had suffered at least two previous myocardial infarcts several years before. Note that the electrocardiogram is abnormal on the day of the attack but the characteristic changes of acute myocardial infarction are not present. Although

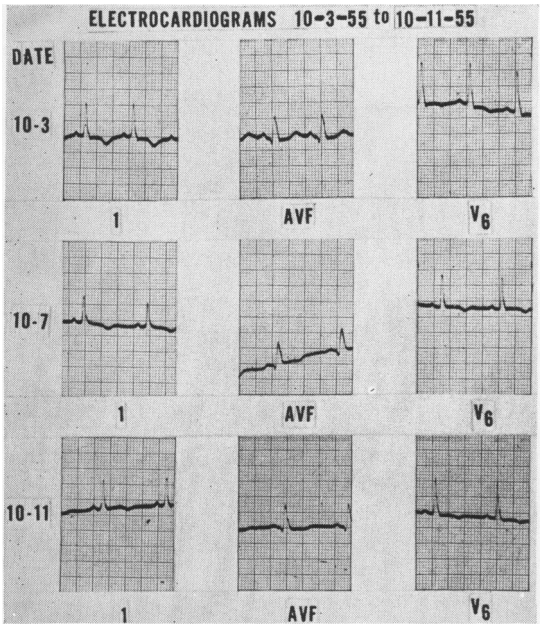

Fig. 2—Serial electrocardiograms on first, fifth and ninth days following acute myocardial infarction in a patient with two previous remote myocardial infarctions. Note absence of E.C.G. signs of acute infarction.

tracings were made serially for about 10 days there were no evolutionary changes which could be considered pathognomonic of recent myocardial infarction. It is in this type of case that the recently developed serum glutamic oxalacetic transaminase test is of great diagnostic value.[4]

SERUM GLUTAMIC OXALACETIC TRANSAMINASE CONCENTRATION IN ACUTE MYOCARDIAL INFARCTION

Serum glutamic oxalacetic transaminase (hereafter called transaminase) is a catalytic enzyme which permits the transfer of the alpha amino nitrogen of aspartic acid to alpha ketoglutaric acid with the synthesis of glutamic acid. This enzyme is present in many tissues of the body and can be demonstrated in decreasing quantities respectively in heart muscle, skeletal muscle, brain and liver.[5] Acute destruction of heart muscle as occurs in acute myocardial infarction results in a rapid increase of the transaminase concentration in the blood stream, above the normal value of 10 to 40 units. This rise begins within four to six hours after onset of infarction, rapidly reaching a maximum concentration in 24 to 36 hours. The concentration gradually declines to normal by the seventh day, providing no new additional infarction occurs.[4] This transaminase test undoubtedly will find great usefulness in the problem cases such as in those cases in which infarction develops in the presence of left bundle branch block or the development of an infarction in a patient with previous multiple infarctions in whom the electrocardiogram was already considerably distorted prior to the episode in question.

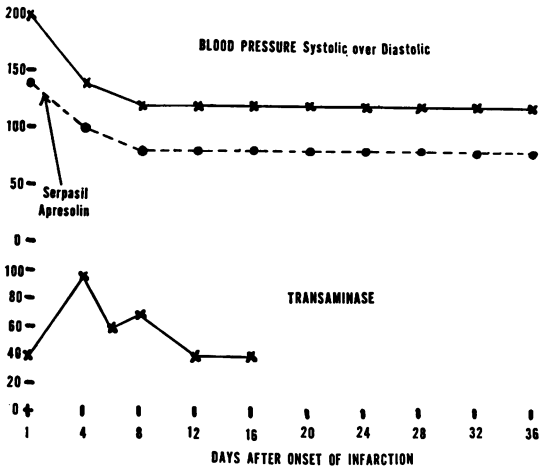

Fig. 3—Showing effective hypotensive medication starting third day following acute myocardial infarction. Lower section shows course of serum glutamic oxalacetic transaminase concentration following acute infarction in patient referred to in Figure 2.

Figure 3 shows the pattern of serum transaminase concentration in the patient whose electrocardiograms are shown in Figure 2. This behavior of the serum transaminase adequately confirmed the clinical impression of acute myocardial infarction although the serial electrocardiogram was of little assistance in confirming the clinical diagnosis.

Prior to the time when electrocardiography was generally available, acute myocardial infarction, presenting somewhat atypical symptoms, was diagnosed with difficulty. Uncertainty in many of the cases of this type was then readily resolved with the aid of the electrocardiogram. Now with the aid of a good clinical history, the electrocardiogram and the estimation of the serum transaminase, it should be rare indeed that the physician should err in the diagnosis of acute myocardial infarction, once the disorder is suspected.

TREATMENT OF THE ACUTE ATTACK OF MYOCARDIAL INFARCTION

In instituting therapy for the individual patient we have found it useful to consider systematically

TABLE 1

Clinical State	*Recommended Management*
Severe pain	Morphine—gr. ¼, repeat every 30 min. for 3 doses. Watch for respiratory depression, start with gr. ⅙ in elderly patients. Brandy or whisky, one ounce several times daily; I.V. ethyl-alcohol 5%, 500 cc. by slow drip may be effective in conjunction with or without morphine sulfate—Often gives a valuable euphoria.
Anoxia	Oxygen by nasal tube or tent—this may help in relief of pain, shock, heart failure, dyspnea, or arrhythmia.
Shock	1. Vasopressor drugs generally most satisfactory. a. Norepinephrine—4 cc. in 1000 cc. 5% glucose. The concentration may be doubled or tripled—8 or 16 cc. per liter if needed. Vary flow rate 70-80 drops per min. to maintain B.P. at desired level. b. Ephedrine—5-15 mg. I.V. followed by regulated drip (35-70 mg. in 100 cc. 3% glucose). c. Wyamine (Mephentermine) 35-70 mg. in 100 cc. 5% glucose by I.V. drip 1-2 hrs., adjust flow rate to maintain desired B.P. 2. Plasma or whole blood to be used if evidence of anemia or reduced blood volume is present. 3. Digitalization—if coexisting cardiomegaly with heart failure use I.V. digoxin 0.5 mg. I.V. every 4 hours for 3 or 4 doses as needed.
Apprehension	Barbituates valuable. Talk with patient about his condition and give assurance. Arm chair treatment as discussed below.
Gen'l. measures	Use bed side commode instead of bed pan. Do not confine to bed but allow patient to be placed in chair at bedside if patient can tolerate same. (Chair treatment—Levine).
Extension of thrombosis, venous thrombosis and mural thrombi	If urgent anticoagulation required: Heparin—75 mg. I.V. 24 hrs.—keep coagulation time at 30 min. *Dicumarol*—200-300 mg. daily until prothrombin time is reduced to 20-30%; 150-200 mg. daily thereafter to maintain prothrombin time at 20-30% of normal. *Tromexan*—first 24 hrs. 1500 mg. daily dose thereafter 600-900 mg. as necessary to maintain prothrombin time at 20-30% of normal. *Phenindione*—(Hedulin) or (Danilone)—may be used. Initial dose 200-300 mg. maintenance dose 25-250 mg. daily (maintain prothrombin time at 20-30% of normal).
Arrhythmia	Frequent premature auricular or ventricular impulses may forewarn of fatal auricular tachycardia or flutter, or ventricular tachycardia respectively. Quinidine sulfate 0.2 mgs. stat and 2-3 times daily as needed orally. Ventricular tachycardia— a. Quinidine lactate, gluconate or hydrochloride 1 gm. in 300 cc. 5% glucose, I.V. by slow drip and maintain by oral quinidine. b. Pronestyl HCl.—0.2 gm. to 1.0 gm. I.V. slowly with ECG control. Watch to prevent severe hypotensive effect. c. Isuprel—I.V. Auricular tachycardia—Try carotid sinus pressure, quinidinization or digitalization.
Congestive heart failure	Digitalis in myocardial infarction. (See discussion.) If mild, use diuretic—Thiomerin. Salyrgan-Theophyllin. If severe—Diuretics plus digitalization and oxygen.
Reduction in cardiac work	"Arm chair treatment"—Low caloric diet—Reduce peripheral resistance to systemic blood flow. (See discussion.)

those signs and symptoms which have ominous implications. Further it had been found important to anticipate and institute prophylactic therapy for certain of the common complications associated with acute myocardial infarction. Therapy, then, is directed with particular reference to the following*:

1. Pain
2. Anoxia

* Not every patient, of course, will show all of these major manifestations simultaneously.

3. Shock
4. Restlessness and apprehension
5. (a) Extension of thrombosis in coronary artery
   (b) Thromboembolic phenomena e.g., mural thrombi and venous thrombosis
6. Arrhythmia
7. Congestive heart failure
8. Reduction in cardiac work
9. Cardiac aneurysm and cardiac rupture

An outline plan of therapy in relation to the major signs and symptoms listed above is to be found in Table 1. Particular attention is called to therapy in relation to anticoagulants, the treatment of shock, reduction in cardiac work, and the treatment of congestive heart failure.

DISCUSSION

ANTICOAGULANT THERAPY—SELECTION OF CASES

Some aspects of the treatment proposed above deserve comment since, in some instances, considerble controversy still exists.

Anticoagulant therapy in acute myocardial infarction is probably the most important recent therapeutic advance in the treatment of the acute episode. All investigators seem agreed that anticoagulant therapy is desirable at least in the "poor risk" patient. The point of controversy is: "How can the "poor risk" patient in acute myocardial infarction be recognized?" Wright, Beck and Marple working with the Committee on Anticoagulants of the American Heart Association seem to endorse the position that: 1) thromboembolic complications are potentially fatal; 2) have a high incidence even in the so-called mild cases and; 3) therefore, all cases of acute myocardial infarction should have anticoagulant therapy if available.[6] They admit, however, that the elderly, obese patient with severe onset, with gradual development of shock or heart failure, or who develops a serious arrhythmia has a much poorer outlook for survival than if none of these complications is present.

On the other hand Russek and others have indicated that the mortality rate in acute myocardial infarction is consistently higher in patients who develop certain symptoms and complications.[7, 8] Russek has designated the "poor risk" myocardial infarction patient as follows:

PROGNOSTIC CRITERIA WHICH CLASSIFY PATIENT AS "POOR RISK" IN ACUTE MYOCARDIAL INFARCTION

1. History of a previous myocardial infarction
2. Presence of intractable pain
3. Severe continuing shock
4. Development of congestive heart failure
5. Development of arrhythmia such as paroxysmal auricular tachycardia, auricular fibrillation, auricular flutter, frequent ventricular ectopic beats from multiple foci and heart block
6. Development of thromboembolic phenomena
7. Presence of greatly enlarged heart.

The "good risk" patient is free of the above features. Age, alone, does not give poor prognosis.

Using this classification, Russek was able to demonstrate significant differences both in mortality rate and thromboembolism between the "poor risk" and the "good risk" patient as follows:

MORTALITY RATE AND THROMBOEMBOLIC COMPLICATIONS IN ACUTE MYOCARDIAL INFARCTION[7]

Classification	*Mortality*	*Thromboembolism*
"Good risk"	3.4%	1.3%
"Poor risk"	60%	11.5%
First attack	33.8%	6.8%

We are in agreement that anticoagulant therapy should be used widely in the management of acute myocardial infarction. However, we, like Russek favor the "selective versus routine" use of anticoagulants in acute myocardial infarction, using such prognostic criteria as listed above in designating the "poor risk" patient.

DIGITALIS IN ACUTE MYOCARDIAL INFARCTION

The problem of digitalis administration in acute myocardial infarction has been the source of much concern to clinicians. There is always the fear that digitalis administration may result in ventricular tachycardia and ventricular fibrillation or that the increased force of ventricular contraction which digitalis produces, may cause the infarcted ventricle to rupture. These fears may be responsible

for denial of digitalis in acute myocardial infarction, complicated by congestive heart failure. The digitalis fear in reference to ventricular tachycardia appears to be based largely on physiological and pharmacological observations that injured areas of ventricular muscle often show foci of automatic activity and at least in acute animal experiments, using toxic doses of digitalis, the hazard of ventricular ectopic rhythm is greatly enhanced.[9] Few clinical studies in patients on this subject have been done. In a carefully controlled study by Askey, in which digitalis was administered to patients with myocardial infarction, no evidence was found to indicate that digitalis therapy induced ectopic rhythms or resulted in increased incidence of sudden death as compared with a control group.[10]

We accept the principle that heart failure is a primary indication for digitalis therapy whether myocardial infarction is present or not. In those patients with mild congestive heart failure associated with myocardial infarction, one should attempt to control the heart failure initially by means of mercurial diuretics. Thiomerin (1 cc.) subcutaneously daily for two or three days may be adequate in the mild case of congestive heart failure. If the heart failure is severe in the patient with myocardial infarction, digitalization should be done during the first 24 hours, using repeated small doses up to a total of 1.0 or 1.5 milligrams of digoxin as tolerated. In occasional cases the very serious combination of shock and heart failure is seen in the same patient simultaneously in acute myocardial infarction. This complication occurs more commonly in patients with previous heart failure or previous myocardial infarction and can often be suspected if the patient has distended cervical veins and elevated venous pressure simultaneously with shock. In many such cases the shock may be unresponsive to vasopressor drugs until the patient has also been fully digitalized.

SHOCK

The importance of shock as a grave prognostic sign in acute myocardial infarction cannot be emphasized too strongly. The mortality rate has been reported as high as 80 per cent.[3] In coronary ligation studies in dogs, the experimental production of shock after coronary artery ligation results in great reduction of coronary flow to the remaining normal muscle, accentuated "ballooning" of the infarcted area with associated cyanosis.[11] Shock is considered to be present if the blood pressure falls below 80 mm. Hg. In previously hypertensive subjects, circulatory collapse may appear at systolic pressures above 100 mm. Hg. The degree and persistence of shock obviously will alter the patient's prognosis. Prompt effective therapy will significantly improve the patient's chances for survival.[12] Although there is still some uncertainty as to the exact mechanism of shock in acute myocardial infarction, there is no controversy over the fact that this type of shock is generally not associated with an immediate reduction in blood volume; and that, therapy is desirable which raises the peripheral resistance, increases the aortic pressure and coronary flow with minimal adverse effects on the heart itself. Certain of the vasopressor drugs, as outlined above in the table on treatment, are very effective and in many instances may be life saving.[13, 14]

It is to be noted that in occasional instances severe shock in acute myocardial infarction continues toward a fatal issue, in the absence of heart failure in spite of adequate vasopressor drugs. It has been demonstrated in animals, that the vasopressor responsiveness of the circulation soon becomes exhausted during continuous nor-epinephrine administration, if the animal had previously had bilateral adrenalectomy. Further this vasoresponsiveness can be restored by the administration of adrenal cortical extract.[15] On the basis of these studies, patients with acute myocardial infarction who develop severe persistent shock might well be given a trial of whole adrenal cortex extract or some form of C-11 oxysteroids such as cortisone, when adequate vasopressor drugs fail to maintain the blood pressure above shock level.

In the consideration of the management of the "poor risk" case by the measures outlined above, one must not be lulled into complacency in the individual case when all these measures have been instituted. This caution is particularly pertinent in those cases of infarction where an area of ischemic muscle acts as a "trigger" area which sets up a destructive electrical mechanism of the heart, annihilates the heart's function as a pump, and results in sudden death.

In these cases the need is for a few additional cubic centimers of blood flow per minute.[16] Anti-

coagulant therapy is not known to increase the coronary blood flow in man. Drugs commonly used to combat ectopic rhythms may be ineffective, or the episode may occur with such rapidity that the condition cannot be recognized in sufficient time for the administration of the indicated medication.

REDUCTION IN CARDIAC WORK

Reduction of cardiac work in patients with acute myocardial infarction is a traditional therapeutic principle. Levine in his proposal of the arm chair treatment of acute coronary thrombosis pointed out that "putting the heart at rest" by prescribing "six weeks flat in bed may well be a dangerous myth."[17] The recumbent position facilitates maximum venous return from the periphery, increases venous pressue and blood volume, therefore, actually augments the work of the heart. Overnight enforcement of prolonged absolute bed rest in a previously active middle aged man enhances increased anxiety, loss of morale, constipation, and phlebothrombosis which are other potential harmful side effects. We subscribe to Levine's concept in this regard, so that by the end of the first week of the attack depending on the stabilization of the blood pressure we have our patient lifted into a comfortable chair where he is allowed to remain for short and increasingly longer periods, and by the end of the third or fourth week the patient is allowed to take a few steps. During the second and third weeks the patient is allowed to assist in feeding himself and by preference is permitted to use the bed side commode instead of the bed pan.

The major intrinsic factor in increased ventricular work is increased peripheral resistance as seen in hypertensive cardiovascular disease. Little attention has been paid to the therapeutic reduction of peripheral resistance in the management of intractable hypertensive heart failure and perhaps even less so in relation to reduction of cardiac work in acute myocardial infarction. In previous studies reported by our laboratory we have shown that reduction of peripheral resistance and of ventricular work against pressure by ganglionic blocking agents may so improve ventricular efficiency as to allow cardiac compensation in patients with otherwise intractable hypertensive heart failure.[18] The decrease in ventricular work against pressure, and

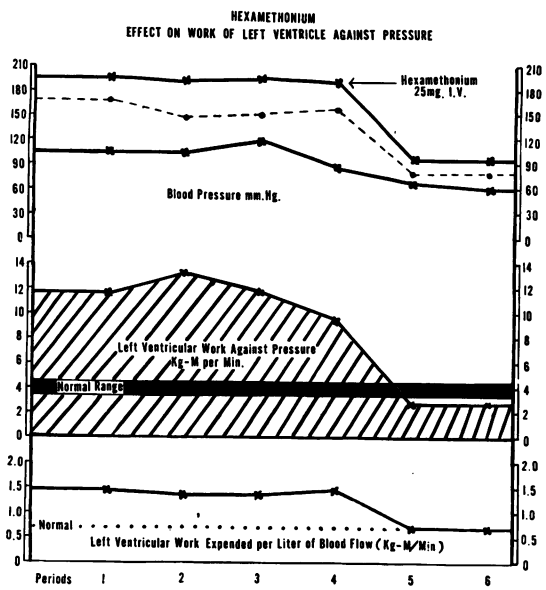

Fig. 4—Reduction of left ventricular work and reduction of left ventricular work per liter of blood flow produced by reduced systemic blood pressure and peripheral resistance using intravenous hexamethonium.

conversely the amount of ventricular work per liter of blood flow, is remarkably altered in favor of increased ventricular efficiency. Figure 4 illustrates the decreased ventricular work against pressure in a hypertensive patient following the parenteral administration of hexamethonium.

We propose, therefore, that in the patient with acute myocardial infarction, if the hemodynamic state stabilizes with the blood pressure at a significant hypertensive level following the acute attack, therapeutic reduction of the abnormally high peripheral resistance should be an integral part of the treatment of the acute myocardial infarction. The hypotensive agent, of course, should be given carefully with the necessary observations to secure an optimum blood pressure for the individual patient in question. We have applied this principle successfully in some of our patients with acute myocardial infarction. Figure 3 shows the reduction in systemic pressure in a severely ill physician who had had two previous major episodes of acute myocardial infarction. Prior to this third infarction his hypertension had been uncontrolled and there were continued moderate symptoms of left heart failure, which persisted at the time of admission to the hospital. These heart failure signs and symptoms were easily controlled (without digitalization) by reducing his blood pressure

nearly to normal, and by the administration of several doses of Thiomerin subcutaneously.

Reduction in caloric intake undoubtedly is an effective additional means of reducing cardiac work. It has been demonstrated that the basal metabolic rate, blood pressure and heart rate may be significantly lowered as the caloric intake is reduced from 2000 to 800 calories, thus reducing the basal demands on the cardiovascular system.[19, 20]

PROPHYLAXIS AGAINST ACUTE MYOCARDIAL INFARCTION

Prophylaxis against acute myocardial infarction is one of the most important unsolved problems in American medicine today. This entire problem has recently been brought into sharp focus by the unanticipated attacks among a widely varied group of American statesmen, including the President of the United States himself. Further the recent reports of extensive severe coronary disease demonstrated among young American soldiers (ages 20-36) killed in World War II and among American soldiers killed in action in Korea (ages 18 to 33) have been a cause for alarm.[21, 22] In the latter group 77 per cent of the subjects showed gross evidence of coronary atherosclerosis.

The pathological mechanisms in acute myocardial infarction are quite varied, as pointed out in the introduction of this paper, although in the final analysis severe myocardial ischemia is the critical physiologic effect in each instance. Intravascular blood coagulation appears not to occur spontaneously in the presence of normally functioning intimal endothelium when the physical and chemical state of the circulating blood is normal. The pathogenesis of spontaneous intravascular thrombosis and of disease of the intima (atherosclerosis) are both obscure, so that of necessity, fully effective prophylactic measures against acute myocardial infarction are not now available.

Several observations in regard to spontaneous thrombosis are of interest. It has recently been demonstrated that high grade alimentary lipemia results in a measurable shortening of the coagulation time, thus apparently facilitating spontaneous thrombosis. This alteration occurred in the postprandial state following 80-85 grams of fat but was not observed following meals containing 12-30 grams of fat.[23] Transient increases in blood platelets have been demonstrated following major operations, serious bone fractures and in the post partum state. These observations may have some significance in regard to post-operative or post-traumatic venous thrombosis, but to our knowledge no definitive relation has been established between the development of thrombosis of a branch of a coronary artery and changes in the number or in the quality of the circulating blood platelets.

Atherosclerosis is now a well demonstrated common denominator in practically all cases of spontaneous acute myocardial infarction. The problem of prophylaxis in coronary atherosclerosis has recently been reviewed by Joyner.[24] Unquestionably, diet seems to be of major importance. The low fat diet stands the only proven method of reducing blood lipids. An over-all reduction in fat intake, including vegetable fat, has been demonstrated of greater significance in the control of blood lipids than the special restriction of cholesterol—containing animal fats. The recommended diet should contain about 1 gram protein per kilogram ideal body weight and twenty to thirty (20-30) grams of fat. Carbohydrates should be added to make up the needed calories according to the patients physical activities. Obesity has generally been considered a pathogenic or aggravating factor in coronary atherosclerosis. Recently, however, this concept has been questioned.[25] The high fat content of the diet appears to be the critical factor whether the patient is overweight or not. In the long term low fat diet, adequate fat soluble vitamin supplements should be prescribed. During recent years, efforts have been made to influence the blood lipid pattern and the course of atherosclerosis, favorably, by the prolonged administration of a low fat diet. Although the studies in this field are limited and still experimental, there seems no doubt that the low fat diet should be used widely on a clinical basis in the prophylaxis and therapy of atherosclerosis.[26] Some of the plant sterols, thyroid extract and sex hormones have been demonstrated to be effective anti-atherogenic substances in animals.[27, 28, 29] The unquestioned effectiveness of these anti-atherogenic substances in man still awaits proof.

The injection of heparin has been demonstrated to produce remarkable effects on the plasma lipids in man and animals.[30] In animals atherosclerosis

in cholesterol-fed rabbits can be distinctly retarded by repeated heparin administration.

ANTICOAGULANT PROPHYLAXIS AGAINST INFARCTION IN PATIENTS WITH ESTABLISHED CORONARY ARTERY DISEASE

As our knowledge of acute myocardial infarction has accumulated it has become clear that in some patients, recognizable prodromal symptoms appear which herald the onset of myocardial infarction.[31] Anticoagulant therapy has been used by several investigators as prophylaxis against infarction in such cases with variable results.[32] It has also become clear that in a two year period, the cardiac mortality rate in patients following an attack of acute myocardial infarction is considerable. An increasing number of investigators are instituting long term anticoagulant therapy following acute myocardial infarction in an attempt to improve the mortality rate in these patients. Such therapy appears effective in reducing the incidence of recurrence of myocardial infarction and in reducing the long term mortality rate.[33, 34, 35]. We have advised long term anticoagulant therapy in all of our patients who have had the second attack of myocardial infarction or, who having had one attack, begin to develop prodromal symptoms of a recurrent episode. One of our patients a 59 year old male had his first myocardial infarct in 1949 and a second infarction in 1951. Following the second attack he was started and is now maintained on continuous Dicumarol therapy during the past four years. He is in excellent health, has had no serious hemorrhagic complications, no further infarction and his anginal episodes have disappeared under Dicumarol therapy. After initial regulation, the patient's prothrombin time has been quite readily controlled at 20-40 per cent of normal with a daily dosage of 120 milligrams of Dicumarol. He is now able to do foreign travel while on this regulated dosage of Dicumarol, requiring only monthly prothrombin time determinations.

SUMMARY

Significant advancements in the treatment of myocardial infarction have been made in recent years. The recent introduction of the serum glutamic oxalacetic transaminase test in the diagnosis of atypical cases, appears to be an important diagnostic advancement. It has become increasingly clear that the gradual development of shock or heart failure, the onset of serious arrhythmia, intractable precordial pain, or a history of previous myocardial infarction increases the gravity of the prognosis in myocardial infarction.

There seems to be universal agreement that anticoagulant therapy in myocardial infarction reduces the mortality rate and the incidence of thromboembolic complications. There is some difference of opinion as to whether all cases of acute myocardial infarction should routinely receive anti-coagulant therapy or whether there should be some degree of selection of patients for anticoagulant therapy on the basis of prognostic criteria generally accepted as special factors known to increase the gravity of prognosis. The author favors the latter approach in clinical practice.

Vasopressor drugs are now well established as a necessity in the prompt management of shock. Digitalis therapy for heart failure is highly recommended if the failure is not promptly controlled by mercurial diuretics.

The arm chair treatment during the acute episode seems to have proved well advised. The control of elevated peripheral resistance should be attempted in those patients who maintain persistent hypertension following the acute infarction, as a primary means of reducing left ventricular work.

Coronary atherosclerosis is now a major public health problem in the United States today. The recent demonstration of severe coronary disease in a large percentage of young American soldiers killed in action in Korea has been cause for some alarm. Fully effective prophylaxis against acute myocardial infarction is not now available. A constant low fat (20-30 grams daily) diet seems beneficial in retarding the progress of atherosclerosis. Adequate supplements of fat soluble vitamins should be prescribed in the patient who is placed on a low fat diet of this type.

An increasing number of investigators have reported favorable experience with the use of long term anticoagulant therapy in reducing recurrence of myocardial infarction and in the reduction of mortality in those patients who have already sustained one attack of acute myocardial infarction.

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