Current Practice

DISEASES OF THE HEART AND BLOOD-VESSELS

Recovery After Myocardial Infarction—2

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(Last week's article in *Current Practice* discussed the pathogenesis of coronary thrombosis. This week the "risk factors" and aftercare are described.)

Epidemiological Studies

When a disease such as myocardial infarction is not only common but is especially prevalent in particular communities it is highly probable that environmental factors play a considerable part in the aetiology. Although the precise aetiology of atheroma is unknown, and thus primary prevention is impossible, epidemiological surveys have identified factors that increase the likelihood of developing clinical coronary disease. Therefore if a patient has had a myocardial infarction it will be advisable to eliminate as many of these risk factors as possible. A normal life without symptoms of coronary artery disease may then be possible, provided further intravascular thrombosis and narrowing of the vessels can be prevented.

Prospective studies have been of help in identifying these risk factors and the first and best known of these studies is one which is taking place in a new town in Massachusetts called Framingham. In this town a sample (aged 30 to 59) of the population of 30,000 inhabitants was and still is being studied. They were examined and investigated and their blood-pressure, serum cholesterol, smoking habits, body weight, and other details noted and they were then observed twice a year so that the relationship between those data and subsequent coronary artery disease could be discovered. It was apparent that men with low blood cholesterol and normal blood-pressures, who did not smoke, had one-third of the standard risk of developing coronary artery disease, while if all three factors were present the risk increased tenfold.

The main risk factors in coronary artery disease are:

- (1) HYPERLIPIDAEMIA.
- (2) CIGARETTE-SMOKING.
- (3) HYPERTENSION.
- (4) PSYCHOGENIC STRESS.
- (5) PHYSICAL INACTIVITY.
- (6) OBESITY.
- (7) THROMBOTIC TENDENCY.

Hyperlipidaemia

Hyperlipidaemia is undoubtedly associated with an increased risk of coronary artery disease. Raised serum triglycerides are probably at least as important as high cholesterol levels. Indeed, any mechanism which raises the blood fat will automatically raise the serum cholesterol, as the latter is a vehicle for fatty acids. A high fat diet thus raises the serum cholesterol and a

low fat diet lowers it. It has been shown in prospective studies in man that the risk increases more than fivefold from low to high levels of serum cholesterol. The risk appears to be directly proportional to the cholesterol level, though this is not necessarily a causal relationship.

Population levels of serum cholesterol are sometimes correlated with a high intake of animal fat and a relatively low intake of vegetable oils. It is true that the people of less developed countries have low mean cholesterol levels and little coronary artery disease and the inhabitants of the Western countries, where coronary artery disease is prevalent, have higher blood concentrations of cholesterol and a higher mean intake of animal (saturated) fat. There is, however, no correlation within the communities in which coronary artery disease is prevalent. Thus in people in Britain there is no relationship between the actual fat intake and the height of the serum cholesterol or the incidence of coronary artery disease. Nor is there any evidence that animal fat consumption is greater in Britain today than it was among the well-to-do in the 18th century. Thus, while diet may determine whether the cholesterol level is above or below 180 mg./100 ml., the dietary fat intake appears to have little relevance when the level is above this figure.

CARBOHYDRATES

The serum cholesterol is affected by carbohydrate foods as well as by fats. In carbohydrate-induced hyperlipidaemia most of the dietary carbohydrate is converted into triglyceride by the liver at an accelerated rate and the lipidaemia is derived from this endogenous fat—an overloading of a normal biochemical process. Furthermore, the type of carbohydrate is important, for high starch diets lower the serum cholesterol in patients with hyperlipidaemia and in normal people, while diets high in refined carbohydrates such as sucrose cause hyperlipidaemia. The increased purification of sugar is a feature of the diet of developed countries and may be as important as fats in the pathogenesis of hyperlipidaemia. Sugar consumption in Britain during mediaeval times was negligible. The increased incidence of coronary artery disease and hypercholesterolaemia in the Yemenite Jews since they settled in Israel 25 years ago is associated with a change in diet characterized by an increased intake of purified sugars, for the animal fat content in the diet of Jews in the Yemen is no different, nor is the total carbohydrate of the diet.

Of equal importance may be the fact that the hardening of fats and the processing of flour, which is a feature of the diets of western countries, causes a deficiency in the essential unsaturated fatty acids, as the food becomes increasingly rich in the more saturated fatty acids and unnatural fatty acids. This means that cholesterol becomes esterified with abnormal

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saturated fatty acids and these may be less readily disposed of and so cause atheroma. Since the requirements of males for essential fatty acids is much greater than that of females the consequences of deficiencies are more serious in males. Cessation of ovarian activity prematurely predisposes the female to an increased risk of coronary artery disease and this is associated with elevation of the serum lipids.

The association of hyperlipidaemia with an increased incidence of coronary artery disease does not, however, mean that the raised concentration in the blood is the cause. Increasing evidence, however, suggests that hyperlipidaemia (or the deficiency of essential fatty acids) does result in enhanced platelet stickiness and a tendency to intravascular thrombosis.

LOW CHOLESTEROL DIETS

Although there is good evidence that the levels of cholesterol in the serum can be lowered by diets which are poor in animal fats and rich in vegetable oils, the controlled trials have so far not shown any decrease in the mortality of patients with coronary heart disease as a result of this treatment. In at least one trial patients treated with a low animal fat diet and corn-oil supplements fared considerably worse than the group of patients receiving no dietary treatment, though the serum cholesterol was effectively lowered. Long-term results from treatment with oestrogens are similarly disappointing. Clofibrate (Atromid-S) is a drug which not only lowers cholesterol but enhances fibrinolysis. No controlled trials are yet available to assess its therapeutic value.

There does not seem to be any clear indication to recommend the administration of unsaturated vegetable oils to patients with coronary artery disease. However, if the serum cholesterol is high it would be prudent to lower it by reducing the intake of animal fat. The American Heart Association considers the evidence for the harmfulness of dietary fat is sufficiently strong for it to have advised the general public to reduce the intake of saturated fats, which are found largely in the diet as animal fat, and to increase intake of vegetable fats and oils. It is also worth remembering that the concentration of neutral fat in the blood is influenced not only by the amount of fat in the diet but also by the eating pattern—nibbling throughout the day causing less hyperlipidaemia than gorging once or twice.

Cigarette-smoking

Epidemiological surveys have shown that there is a three-fold increase in the mortality of coronary artery disease among cigarette smokers. The relationship to smoking is most marked in the younger age groups. There is no correlation with the severity of atheroma but only with coronary thrombosis. This association itself does not establish that smoking is a cause of coronary artery disease. However, the rising gradient of mortality from non-smokers to heavy smokers and the fact that the risk of disease falls after stopping smoking leaves little doubt that this is a causal relationship.

Furthermore, patients with coronary artery disease respond to nicotine in an abnormal manner and smoking often impairs the performance of the heart damaged by disease.

Hypertension

The incidence of coronary artery disease increases with the rise of the blood-pressure and individuals with a systolic blood-pressure of over 180 mm. Hg have a seven times greater chance of developing coronary artery disease than those with a systolic blood-pressure of less than 120 mm. Hg. It is, however, not known whether it is the raised pressure itself or its underlying genetic or renal causes which determines the probability of

developing coronary artery disease. Although it has not been proved that control of blood-pressure decreases the risk of further myocardial infarction in addition to the known beneficial effects on cerebral haemorrhage, renal failure, and heart failure, it is obviously wise to control the blood-pressure in patients who have suffered myocardial infarction. Even if it has no effect on the subsequent risk of thrombotic occlusion it will certainly reduce the risk of heart failure.

Psychogenic Stress

The high incidence of coronary artery disease among business executives and others under constant pressure has led many to speculate that stress may be an important factor in coronary artery disease. Mounting stress of emotional origin is a feature of many patients (in one series the figure was 49%) suffering myocardial infarction. Psychogenic stress, however, is not a factor that is easy to control nor is it of equal importance to different individuals. The anxious fearful patient may be overwhelmed by the same challenge that promotes a sense of satisfaction in another.

A lack of security is, however, a potent source of worry to most people. It would therefore be unwise to remove a patient from a physically active job that he has been doing all his life in order to avoid fatigue. The worry produced by financial insecurity or the frustrations of doing a new job, to which he is not suited or enjoying, may exceed the possible harm that might be induced by fatigue.

Physical Inactivity

Ever since it was shown that the drivers of double-decker London buses were more likely to develop clinical coronary artery disease than conductors, and clerks more than postmen, the role of physical exercise in the prevention of the disease has been stressed. There is no doubt that men in physically active jobs have a lower incidence of coronary artery disease in middle age than those in sedentary jobs. More important, however, is the fact that the disease is not so severe in physically active workers. The trend for coronary artery disease to be more common in the upper social classes disappears when the social classes are broken down into categories of physical activity. Physical activity is a protection against ischaemic heart disease. Thus in patients who have had a myocardial infarction restriction of physical activity beyond that imposed by diminished cardiac reserve not only fails to prevent further deterioration but hastens it, for it has been shown that manual workers, who for economic reasons must go on working after an attack of myocardial infarction, have a better expectation of life than white-collar workers.

Obesity

There is an increased incidence of coronary artery disease in patients who are overweight. The significance is more striking when skinfold thickness is taken as the measure of obesity, suggesting that it is the fatness rather than the body weight itself that is important. Individuals who are obese tend to be less physically active than those of normal weight and this may be the relevant factor. Obesity also increases the work of the heart and predisposes towards hypertension.

Thrombotic Tendency

There seems little doubt that platelet thrombi and fibrin deposition contribute to the narrowing of atheromatous blood vessels. Furthermore, thrombosis tends to develop on pre-

existing atheroma, and is the immediate cause of arterial obstruction in most patients dying of myocardial infarction. This tendency to increased intravascular thrombosis is different from hypercoagulability of the blood, for it depends on platelet function and plasma factors which are not clotting factors. Recent evidence suggests that the increase in coronary heart disease is due to the fact that the incidence of thrombosis is increasing. From the therapeutic point of view any reduction in the degree of atheroma so that the lesions were too small to form a basis for thrombosis would have to be very radical to show any beneficial results. Efforts must therefore be directed to reducing the incidence of intravascular thrombosis.

There are two aspects to thrombosis, the first being the general tendency to intravascular thrombosis due to a change in the circulating blood and the second is the local disturbance which provides the site on which the platelet thrombi may form. It has been shown that plasma factors which precipitate platelet aggregation are present in patients with atheroma, and, indeed, are also present in patients with diabetes mellitus and familial hypercholesterolaemia, both of which are conditions with an increased incidence of coronary heart disease. These plasma factors can be reduced to normal by the administration of linseed oil, which contains the essential fatty acid linolenic acid, but it has yet to be shown that this reduces the incidence of coronary heart disease. Although diets low in saturated animal fats and rich in vegetable oils may lower the serum cholesterol, they do not provide any increase in linolenic acid unless they contain soya-bean oil, and this may be relevant to the failure to demonstrate any enhanced survival in patients with myocardial infarction treated with low animal fat and high vegetable oil diets.

Uncertain Treatments

Anticoagulants, fibrinolytic agents, and vasodilator drugs are often recommended with unreasonable enthusiasm and without any good scientific evidence of their benefit.

The fact that after 20 years of clinical use there is no complete agreement on the place of anticoagulants is a reflection on our inadequate methods of drug trials. In many trials a failure to appreciate how the selection of cases affects the mortality rates of myocardial infarction has rendered their results unreliable. However, it is becoming increasingly apparent that there is no place for prolonged therapy with anticoagulants after myocardial infarction. In no trial yet has the treated group had a survival rate above the upper limit of the range expected in untreated cases. While there is clear evidence that anticoagulants can reduce the prevalence of venous thrombosis and pulmonary embolism in patients restricted to bed, there is no evidence that they have any beneficial effect on the arterial thrombosis itself. Thus in patients confined to bed for the acute episode anticoagulants should be given. Oral anticoagulants have, however, no beneficial effect on platelet adhesiveness or intravascular thrombosis, so that prolonged therapy is rarely indicated.

Fresh blood has spontaneous fibrinolytic activity—that is, it has the capacity to dissolve fibrin. This ability is reduced in

coronary heart disease. If fibrinolysis has a role in maintaining patency of the coronary vessels any decrease in fibrinolytic activity might impair recovery from intravascular thrombosis. Agents which enhance fibrinolytic activity are now available, but it has been shown that they do not improve the prognosis of acute myocardial infarction. It might be argued that in most patients with myocardial infarction the intravascular thrombosis is the last stage of progressive atherosclerotic narrowing, so that even if the most recent occlusion is cleared by fibrinolysis the coronary vessels remain narrowed. Furthermore, fibrin does not contribute greatly to the bulk of an arterial thrombus, and this may explain the lack of therapeutic benefit from fibrinolytic agents. There is thus at present no evidence that fibrinolytic agents are of value in the patient with clinical coronary artery disease.

Digitalis is indicated only for those patients who develop cardiac failure or for those in whom the ventricular rate must be controlled on account of atrial fibrillation. It should not be given without clear indications, as its tendency to precipitate arrhythmia is potentially hazardous in patients with coronary artery disease.

While "coronary vasodilator" drugs are indicated in patients with angina of effort, there is no evidence that they are of benefit to patients without angina. It is doubtful in fact whether this group of drugs does produce vasodilatation of atheromatous coronary vessels, and recent evidence suggests that their beneficial effect in angina is due to lowering peripheral resistance and reducing cardiac work.

Conclusion

The management of the patient who has recovered from a myocardial infarct should include an attempt to reduce as many of the risk factors as possible. Some are more easy to correct than others. Patients who are obese must lose weight. Cigarette smokers should stop. Hypertension should be controlled. Physical activity should be encouraged. If the serum cholesterol is high some reduction in the intake of saturated (animal) fats should be encouraged, but it is premature to advocate the use of specific vegetable oils. The curtailing of saturated fats means reducing meat fat and milk fat and those cooking fats which are solid at room temperature. Unsaturated fats such as olive oil or maize oil may be used for cooking. Restriction of alcohol is not indicated, as there is no evidence that alcohol predisposes towards coronary artery disease.

Fear and despair are common results of a sudden heart attack. Reassurance and encouragement are therefore essential for the reduction of psychogenic stress. Work in which the patient is happy and not unduly rushed should be sought, but the transfer of a patient to a job to which he is not adapted should be avoided. After the initial attack of myocardial infarction the resumption of work should not be delayed longer than three months after the onset unless there are any specific indications for more prolonged convalescence. If the requirements of a previous occupation exceed the capacity of the cardiac patient, return to work may require modification of the job, vocational retraining, or selective transfer.