The Cause of Death, Risk Factors and Long-Term Prognosis of Acute Myocardial Infarction

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Three hundred and eighty-six patients with acute myocardial infarction in the past 11 years between 1975 and 1985 were investigated retrospectively to clarify fatality, cause of death and long-term prognosis in relation to their risk factors and age. The average number of patients admitted in each year was 24.4 for the first 5 years and 44.0 cases per year in the last 5 years. The fatality decreased from 20.3% in the first 5 years to 15.7% in the last 5 years. A major cause of hospital death was cardiogenic shock and congestive heart failure. One hundred and thirty-six patients had coronary arteriography within 2 months after admission. They were divided into three groups; the young (≤40 year old), middle (41–50 year old), and old (≥51-year old)-aged groups. Among the young-aged group, serum cholesterol levels at admission were significantly higher in patients with multi-vessel lesions than those in patients without multi-vessel lesions, while there were many heavy smokers who did not show a significant lesion of the coronary artery. These observations suggest that hypercholesterolemia may act as an important risk factor for coronary arteriosclerosis in young patients, and also that a heavy smoking may promote an initiation of myocardial infarction in young patients without severe coronary artery stenosis. The cumulative 5 and 10 year survival rate for all groups was 84% and 61%, respectively. Fifty-seven patients had reinfarctions, and thirty patients died. The survivors were younger and had a good tolerance to treadmill exercise test at discharge.

The fatality of acute myocardial infarction (AMI) has been decreased by a proliferation of coronary care units (CCU) and recent progress in the therapy of AMI, congestive heart failure, arrhythmia, etc. The initial therapy of AMI in CCU applies an energy toward treatments for cardiogenic shock and severe heart failure as well as for fatal arrhythmia. However, the fatality of AMI is still high, especially in the case of reinfarction. To further decrease the fatality of AMI, education for individuals with increased risk factors is important. Although there are many studies describing risk factors and long-term prognosis in AMI, there are few studies in which a relationship between coronary artery lesions and risk factors or long-term prognosis was investigated.

In the present study, we investigated the clinical profile and prognosis of 386 patients with AMI in the past 11 years. In addition, among these patients 136 cases who had been examined by coronary arteriography were analyzed with respect to their risk factors and severities of coronary artery lesions.

Key words:
Acute myocardial infarction
Cigarette smoking
Total cholesterol
Coronary artery lesions

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SUBJECTS AND METHODS

The subjects were 386 patients (average age 60.9 ± 11.8 years) who were admitted to Wakayama Medical College hospital from 1975 to 1985; 313 males and 73 females. All of the patients had no prior history of AMI. Patients admitted with re-infarction were excluded and analyzed elsewhere. The changes in number of patients, fatality and cause of death were examined in one year intervals. Of these patients, 136 cases had been examined by coronary arteriography within 2 months after admission. The coronary arteriography was performed by the Judkins’ technique. In several cases, an urgent coronary arteriography had been performed. These patients were then divided into three-aged groups; the young (under 40 year old), middle-aged (41–50 year old) and older (over 51 year old). In each group, the relationship between the number of major coronary arteries with significant stenosis and risk factors was investigated. A significant stenosis was defined as a lesion which occluded the lumen by 50% or more. A presence or absence of risk factors such as hypercholesterolemia (> 230 mg/dl) on admission, smoking, history of hypertension, diabetes mellitus and hyperuricemia (> 6.8 mg/dl) were examined with respect to the severity of coronary artery disease.

Long-term prognosis was investigated using a questionnaire for the 327 patients who were discharged alive. Among these patients, the re-infarction was observed in 57 cases (17.4%); of these 57 patients, 27 survived and 30 died. The difference in exercise tolerance on discharge (as evaluated by treadmill) was compared between the survivors and the non-survivors.

For a statistical analysis, the χ²-test was employed. The difference with p < 0.05 was evaluated as statistically significant. All data are shown mean ± SEM.

RESULTS

I. Number of patients, fatality and cause of death

The yearly number of patients and fatality of AMI are shown in Fig. 1. The number of patients admitted with their first AMI has increased gradually, the average number of patients admitted was 44.0 cases a year in the recent 5 years. The fatality during admission was high in the first 2 to 3 years, but decreased to 19.6% in 1980 and to 13.6% in 1985. With the advance of therapy, the observation period was divided into the following two groups; the first 6 years from 1975 to 1980 and the last 5 years from 1981 to 1985 in order to analyze a cause of death during admission. As shown in Fig. 2, a cardiogenic shock, congestive heart failure, cardiac rupture and arrhythmia were 28%, 25%, 16%, respectively in the first 6 years. Although the death due to fatal arrhythmia decreased to 3%, death due to low cardiac output such as cardiogenic shock or heart failure has increased in the last 5 years. Low cardiac output was the major cause of death in AMI. Ventricular rupture accounted for 10%
Fig. 2. Causes of death in patients with acute myocardial infarction.

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Fig. 3. Total cholesterol levels and the number of stenosed coronary arteries by age group.
Values are expressed as mean ± SD. **p < 0.01

of the deaths during the past 5 years.

II. Coronary artery stenosis and risk factors
Comparison of risk factors in the three-age groups was made with respect to the severity of coronary arteriosclerosis. Hypercholesterolemia was observed in 65% of the younger-aged group. The percentage of heavy smokers (> 20 cigarettes

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a day) was higher in both young- and middle-aged groups than that in the old-aged group. As for the other risk factors, there was no difference among the three-age groups (Table I). Serum cholesterol levels on admission in relation to the number of stenosed coronary artery are shown in Fig. 3. In the young-aged group, the total cholesterol levels were significantly higher in patients with multivessel lesions than those in patients without multivessel lesions. No significant relation was observed between total cholesterol levels and numbers of lesioned vessels in the middle- and old-aged groups.

There was the relationship between the number of cigarettes smoked daily and the severity of coronary artery lesions is shown in Fig. 4. Among the young- and middle-aged patients, there were many heavy smokers without a significant coronary artery lesion, while the number of cigarettes smoked daily were not so many in patients with multivessel lesions.

III. Long-term prognosis

The investigation on the long-term prognosis was conducted using a questionair in the 327 survivors. There were 224 survivors and 49 non survivors (15%). The confirmation rate was 83.7%. The cumulative survival rate was 84% in the first 5 years and 61% in the 10 years, respectively. The recurrence of AMI was observed in 57 cases, of these 57 only 27 survived. Comparison of the survivors and non-survivors revealed an older average age for the non-survivors. In addition, the exercise tolerance of the non-survivors was significantly less than that of those still living (Table II). All of the patients who did not survive a recurrent AMI had a positive treadmill test at 6 METs of work.

DISCUSSION

The number of patients with AMI admitted to our hospital increased gradually up to 1980, and has remained at a relatively constant level thereafter. In the first 5 years, the average number of patients admitted per year was 24.4 and increased to 44 per year in the last 6 years. This increase in the number of patients with AMI may be due to numerous factors. One is an increase in ischemic heart disease, and another is the increased recognition for AMI. The fatality of AMI when treated in the CCU has been shown to be 15.5% to 22%. The data from our institution demon-
strates that the fatality has decreased dramatically over the last 5 years from 20.3% to 15.7%. Since 1980, it has become possible to monitor the patients hemodynamics using the Swan-Ganz catheter inserted into the pulmonary artery, and to use vasodilators and catecholamines for improvement of abnormal hemodynamics in AMI. These diagnostic and therapeutic advances may contribute to the recent decrease in fatality of AMI. This study also reveals that the incidence of death due to arrhythmia has decreased with the wide spread use of antiarrhythmic drugs, artificial pacing devices and continuous electrocardiographic monitoring systems. However, the fatality of AMI complicated with cardiogenic shock is still high. In the present study, 63% of the deaths following AMI in the last 5 years was due to cardiogenic shock. Therefore, the treatment for cardiogenic shock or severe heart failure remains a major problem in AMI.

Multiple risk factors for coronary arteriosclerosis have been considered, these include, sex, age, hyperlipidemia, hypertension, obesity, smoking, diabetes mellitus, stress, abnormality in electrocardiogram. The relative importance of these risk factors may be changed or modified by considering the age of the patients. The greater involvement of the risk factor is presumed in the younger patient. The significance of hypercholesterolemia as a risk factor is generally accepted. It has been shown in the Framingham study whatever the associated lipoprotein pattern, the risk for coronary artery disease is proportional to the serum cholesterol level. In our study, young patients with two-vessels lesions showed a significantly higher cholesterol level as compared to young patients without multivessel lesions. Thus, in young patients hypercholesterolemia was related to the severity of coronary arteriosclerosis. In the middle- and older-aged groups, there was no significant relationship between the number of stenosed vessels and serum cholesterol levels. These results are consistent with the report that a high serum cholesterol level is an important risk factor for coronary artery disease in young men and apparently is no longer a risk factor for men over age 65.

Smoking has been shown to be one of the most important risk factors for coronary arteriosclerosis. However, there are several reports indicating that smoking might contribute to the initiation of AMI in younger patients and not constitute an obvious risk factor in older patients. The present study failed show the expected correlation that increased cigarette smoking resulted in an increase in the number of stenosed coronary arteries. Thus, young heavy smokers with AMI did not show severe coronary artery stenosis. There is some evidence that smokers, especially young smokers, who have suffered from AMI may have less diffuse coronary arteriosclerosis and more localized thrombotic obstruction with relatively normal vessels compared with non-smokers with dominant hyperlipidemia as the principal risk factor. It has also been shown that an excessive platelet deposition is a feature in current cigarette smokers, and this phenomenon may be mediated through increased catecholamine secretion in response to nicotine absorption. These observations may, in part, account for the initiation of AMI in patients without a severe coronary artery stenosis. Thus, these implications suggest in young patients that hypercholesterolemia may act strongly as an atherogenic factor, and heavy smoking may be more important as a thrombotic and/or vasospastic factor.

Many factors that may affect the prognosis of AMI have been suggested such as, left ventricular dysfunction, post-infarction angina, ventricular arrhythmias and poor exercise tolerance. Major causes of death in the chronic phase of AMI are the recurrence of AMI, sudden death and congestive heart failure. Particularly the percentage of re-infarction is high. In the Framingham study, the recurrence rate is 4 to 9% in one year and 13 to 20% in 5 years. In this study, 57 of 327 cases had re-infarction (17.6%) in 10 years. Among these patients, 27 were survived and 30 died. Comparing the exercise tolerance at their first discharge, the survival group showed a good tolerance to exercise, although their age was younger than that in the non-survivors. Bruce, et al. have observed that the survival rate in patients with evidence of left ventricular dysfunction such as cardiomegaly, duration of exercise less than 3 min and peak systolic blood pressure less than 130 mmHg was worse in 4 years (67%) even during medical treatment than those with abnormal findings only indicating myocardial ischemia in resting electrocardiogram. Therefore, it is important not only to give “STATE OF THE ART” medical treatment for patients with AMI but to correctly assess their myocardial reserve by exercise tolerance testing and to give instructions to reduce risk factors in their daily lives.

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