Acute Myocardial Infarction in the Young Adults

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A review was done on 631 patients with acute myocardial infarction who underwent coronary angiography within 30 days after onset of myocardial infarction at Yonsei University Severance Hospital from January, 1985, to August, 1993. The incidence of acute myocardial infarction in patients under 40 years of age was 10.3% (65/ 631). Acute myocardial infarction below the fourth decades was the predominant disease of men. Risk factor analysis revealed a history of cigarette smoking and hypercholesterolemia were more frequently found in the young patients, but a history of hypertension and diabetes were more frequently found in the elderly patients. Angiographically, the incidence of one vessel disease and normal or minimal lesion coronary anatomy were more frequent in the young patients and incidence of multi-vessel disease were more frequent in the elderly patients. Of the 65 patients under 40 with acute myocardial infarction, the patients with multi-vessel disease tended to have a history of diabetes mellitus in comparison with those with normal coronary anatomy or one vessel disease.

Key Words: acute myocardial infarction, the young patients

Although there has been an increasing tendency in the incidence of coronary artery disease, acute myocardial infarction is uncommon in the fourth decade (Nixon *et al.* 1976). However, acute myocardial infarction has been recognized in the young age groups more frequently in recent years.

Additionally, myocardial infarction in the young adults may differ from that in the elderly in viewpoint of history of more cigarette smoking (Dolder & Oliver. 1975), more male preponderance (Gurevich 1968).

The purpose of this study was to evaluate the prevalence of various risk factors, to know the extent of coronary artery disease by coronary angiography in the young patients with acute myocardial infarction and to compare those with a population of infarction victims older than 40 years old.

MATERIALS AND METHODS

From January, 1985, to August, 1993, 631 patients with acute myocardial infarction who underwent coronary angiography with or without left ventricular angiography within 30 days after onset of acute myocardial infarction at Yonsei University Severance Hospital were reviewed.

We divided our patients into two groups by their ages. The Group I: 65 patients under 40 (mean age 35.4), the Group II: 566 patients over 40 (mean age 57.5). The Group I was divided into two groups by the extent of coronary artery disease. The Group IA: 52 patients under 40 with normal or minimal lesion coronary anatomy or one vessel disease, the Group IB: 13 patients under 40 with multi-vessel dis-

ease.

Acute myocardial infarction was diagnosed if all three of the following criteria were present: ① sustained chest pain typical of myocardial ischemia, lasting longer than 30 minutes ② initial ST-segment elevation or depression of 1mm or more with or without subsequent development of new Q wave in at least two inferior or anterior electrocardiographic leads ③ elevation of creatine kinase MB fraction value in addition to elevation of creatine kinase value above two times normal range.

Clinical features were compared between Group I and Group II. They were as follows: previous myocardial infarct, preceding angina for more than 1 month before onset of myocardial infarction, cigarette smoking, history of hypertension, history of diabetes mellitus, infarct site, subendocardial infaction (non-Q infarction), hypercholesterolemia (serum total cholesterol 240 mg/dl or more), hypertriglyceridemia (serum triglyceride 200 mg/dl or more).

Left cardiac catheterization and selective coronary arteriography were performed using Judkin's technique. Significant coronary artery obstruction was defined as 50 percent or greater decrease in diameter of a major epicardial coronary vessel to compare with the diameter of reference vessel.

One hundred ninety two patients assigned to receive thrombolytic therapy received intravenous urokinase infusion at a dose of 200-300 million unit over one hour or intravenous tissue plasminogen activator at a dose of 60-100mg over three hours.

The difference of any variable between Group I and Group II was analyzed by Fisher's exact test, Student's independent t-test and Chi-sguare test. Significance was established at the leval of $P < 0.05$.

RESULTS

The incidence of acute myocardial infarction in patients under 40 was 10.3% of all patients with acute myocardial infarction. Comparison of clinical feature between Group I and Group II were presented in Table 1. Male patients suffering acute myocardial infartion were significantly more common in young patients than in the elderly patients ($P < 0.05$). A history of myocardial infarction and of preceding angina for more than one month before onset of myocardial infarction were not significantly different in both groups. The incidence ac-

Table 1. Clinical feature of acute myocardial infaction (%)

|	Group I (n=65)	Group II (n=566)
Mean age(years)*	35.4± 4.0	57.5± 8.6
Sex(M/F)	65/ 0	468/98
Preceding angina(>1 month)	18/56(32.1)	189/463(40.8)
Previous infarct	2/65(3.1)	31/566(5.5)
Infarct site (anterior/inferior)	41/24	326/239
Non-Q infarct	4/65(6.2)	57/566(10.1)
Smoking*	55/65(84.6)	384/566(67.8)
Hypertension*	13/65(20.0)	207/566(36.6)
Diabetes mellitus*	3/65(4.6)	116/566(20.5)
Hypercholesterolemia*	14/63(22.2)	61/546(11.2)
Hypertriglyceridemia	14/56(25.0)	92/446(20.6)

Hypercholesterolemia (total cholesterol ≥240 mg/dl)
Hypertriglyceridemia (triglyceride ≥ 200 mg/dl)
*$p < 0.05$

Table 2. Angiographic findings of acute myocardial infarction (%)

	Group I	Group II
Extent of CAD	15/65(23.1)	39/566(6.9)
Normal or Minimal lesion*	37/65(56.9)	271/566(47.9)
One vessel disease*	13/65(20.0)	256/566(45.2)
Multi-vessel disease*		
Diameter stenosis of infarct related artery(%)*	76.5±30.6	85.1± 9.1
LVEF(%)	54.3± 3.5	52.5± 4.7
LVEDP (mmHg)	16.9± 6.3	18.1± 7.6
Time interval after acute myocardial infarct(days)	9.8± 6.2	10.4± 7.5
Thrombolytic therapy	18/61(29.5)	174/538(32.3)
Duration of symptom to thrombolytic therapy(hours)	7.0±11.4	6.3±9.7

CAD: coronary artery disease, LVEF: left ventricular ejection fraction
LVEDP: left ventricular end diastolic pressure, *$p<0.05$
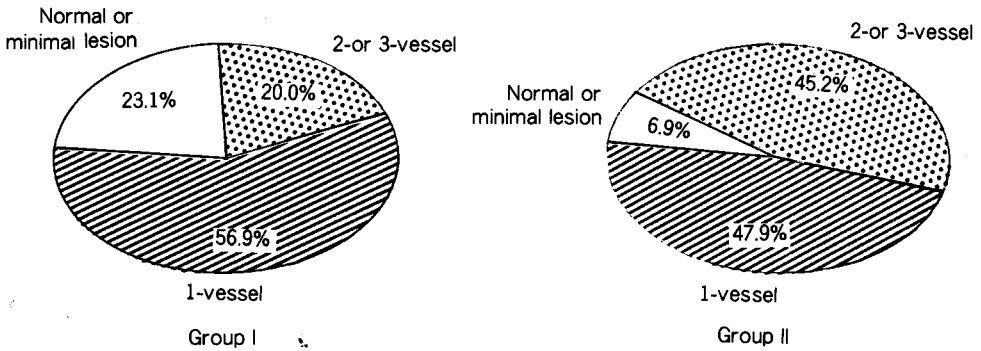
Fig. 1. *Extent of coronary artery disease.*

cording to the site of infarction and non-Q infarction in both groups were not significantly different.

Risk factor analysis showed cigarette smoking to be the most commonly present in both groups (84.6% in group I, 67.8% in group II). Cigarette smoking was significantly more frequent in the young patients ($P<0.05$). However, a history of hypertension(36.6% in Group II vs 20.0% in Group I, $p<0.05$), and a history of diabetes mellitus(20.5% in Group II vs 4.6% in Group I, $p<0.05$) were significantly more common in the elderly patients. Hypercholesterolemia was more frequent in the young patients than in the elderly (22.2% in Group I vs

11.2% in Group II, $P<0.05$)(Table 1).

Angiographically, normal or minimal lesion coronary anatomy was more significantly found in the young patients than in the elderly (23.1 % vs 6.9%, $P <0.05$). The young patients with myocardial infarction had significantly more frequent involvement of a single vessel than the elderly patients (56.9% vs 47.9 %, $P<0.05$). However, significant multi-vessel involvement was more common in the elderly patients than in the young (45.2% vs 20.2% $P< 0.05$) (Fig. 1) (Table 2).

The residual stenosis of infarct related artery was 76.5% in the young patients and 85.1% in the elderly patients ($P<0.05$). There

Table 3. Clinical feature of the young patients with acute myocardial infarction (%)

	Group IA (n=52)	Group IB (n=13)
Mean age(years)*	34.9± 4.1	37.5± 2.4
Preceding angina(>1 month)	13/46(28.3)	5/ 5(50.0)
Previous infarct	1/52(1.9)	1/13(7.7)
Infarct site (anterior/inferior)	34/18	7/ 6
Non-Q infarct	3/52(5.8)	1/13(7.7)
Smoking	43/52(82.7)	12/13(92.3)
Hypertension	8/52(15.4)	5/13(38.5)
Diabetes mellitus*	1/52(1.9)	2/13(15.4)
Hypercholesterolemia	11/51(21.6)	3/12(25.0)
Hypertriglyceridemia	11/48(22.9)	3/ 8(37.5)

*p<0.05

were no significant differences of left ventricular ejection fraction and left ventricular end-diastolic pressures in both groups.

The mean time interval from onset of acute myocardial infarction to coronary angiography was 9.8 days in the young patients and 10.4 days in the elderly patients. Thrombolytic therapy was employed in 29.5% in the young patients and in 32.3% in the elderly patients. The mean time to thrombolytic therapy after onset of acute myocardial infarction was 7.0 hours in the young patients and 6.3 hours in the elderly patients (Table 2).

Of the 65 patients under 40, the patients with normal or minimal lesion coronary anatomy, one vessel disease (Group IA) were younger than the patients with multi-vessel disease (Group IB) (34.9 vs 37.5 year, p<0.05). A history of myocardial infarction, preceding angina for more than one month before onset of myocardial infarction, site of infarction and non-Q infarction were not significantly different between the young patients with normal coronary anatomy or one vessel disease and those with multi-vessel disease. The young patients in Group IB tended more to have a history of diabetes mellitus than those in Group IA (15.4% vs 1.9%, p<0.05) (Table 3).

DISCUSSION

Roubin et al reviewed 229 patients under 60 years of age with acute myocardial infarction who underwent coronary arteriography within 2 weeks after the onset of infarction. The incidence of acute myocardial infarction in patients younger than age 40 years was 12.0%. There were studies that the incidence of acute myocardial infarction in patients younger than 40 years was 5.7~10.7% in Korea (Cho et al. 1987; Seo et al. 1989; Kim et al. 1993). The incidence of acute myocardial infarction in patients younger than 40 years was 10.3% in our study.

Coronary artery disease is much less frequent in premenopausal women than in age matched men. The protection of women from coronary artery disease is much less evident in their menopause. Case-control studies showed angiographically significant benefit in women receiving estrogen therapy in their menopausal period (Sullivan et al. 1988). Myocardial infarction below the fourth decades was predominantly a disease of the men (Cho et al. 1987, Seo et al. 1989, Won et al. 1989, Kim et al. 1993). Our observation that 65 patients (100.0%) were male was in accord with these studies.

Cigarette smoking,which accelerates development of coronary artery disease (Kannel, 1981) and increased thrombus formation (Mustard & Murphy, 1963), may contribute to the onset of myocardial infarction at an earlier age. Most myocardial infarction in young adults have been associated with cigarette smoking in up to 80-90% (Warren *et al.* 1979, Dolder & Oliver, 1975). Uhl & Farrel found cigarette smoking was one of the most common risk factor and the prevalence of smoking was not significantly different between the young patients and the elderly patients. However, our study showed cigarette smoking was much more frequent in the young patients than in the elderly. This results may suggest that the development of myocardial infarction in young adults in different countries was associated with differences in prevalence of risk factors (Dolder & Oliver, 1975).

Hypertension also is a well-known risk factor of coronary artery disease,but appears to be less important in young patients than in the elderly patients. Hypertension before myocardial infarction was much less frequent in the young patients than in the elderly (Wolfe & Vacek, 1988, Uhl & Farrel, 1983). A history of hypertension was significantly less common in the young patients than in the elderly in our study.

Diabetes mellitus is an independent risk factor of coronary artery disease. Coronary atherosclerosis was more extensive as well as more prevalent in diabetic patients than in non-diabetic (Robertson & Strong, 1968). The presence of diabetes mellitus has been implicated in up to one-fourth of patients with early myocardial infarction (Dolder & Oliver, 1975). However, there was significantly lower incidence of diabetes mellitus in young patients with myocardial infaction than in the elderly (Wolfe & Vacek, 1988). A history of diabetes mellitus was significantly less common in the young patients than in the elderly in our study.

The association between hypercholesterolemia and coronary artery disease is now firmly established. Most myocardial infarctions in the young patients have been associated with hypercholesterolemia in 25~89% (Warren *et al.* 1979). Sixty one percent of the young patients had hypercholesterolemia as a risk factor ,while only 31% of the elderly patients had abnormally elevated plasma cholesterol level (Uhl & Farrel, 1983). However, there were interesting differences in the prevalence of hypercholesterolemia as a risk factor of myocardial infarction between eastern and western countries. The cause of different plasma cholesterol level was not known, but dietary habits probably played an important role (Dolder & Oliver, 1975). Hypercholesterolemia was more frequent in the young patients than in the elderly in our study.

Angiographically, the incidence of one vessel disease and normal coronary anatomy was more frequent in the young patients under 35 and the incidence of three vessel disease was more frequent in the elderly patients over 55 (Wolfe & Vacek, 1988). The rate of total occlusion in the young patients was relatively high, which means acute thrombosis of a single vessel lesion as a cause of infarction. The patients with normal coronary vessels may have had subclinical coronary mural abnormalities not detected on coronary angiography which predisposed to spasm or thrombus formation, with subsequent spontaneous clot lysis (Wolfe & Vacek, 1988). Coronary artery spasm may contribute to a partial role of acute myocardial infarction especially in patients with normal coronary artery (Park *et al.* 1992, Takaoka *et al.* 1988). While single vessel disease and normal or minimal lesion coronary anatomy were more frequently found in the young patients, multi-vessel disease were more frequently found in the elderly patients in our study.

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