

# Different Clinical Presentations in Chinese People with Acute Myocardial Infarction in the Emergency Department

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**Background:** The purpose of this study was to investigate the clinical characteristics of younger- ( $\leq 45$  years old) and older-aged ( $> 45$  years) Chinese patients presenting to the emergency department (ED) with an initial acute myocardial infarction (AMI).

**Methods:** A retrospective review of 372 patients who had suffered an AMI (134 younger-aged, 238 older-aged), from 2,858 suspected AMI or ischemia patients during the period January 1996 to June 2003 inclusive, was conducted. Only patients who were diagnosed with AMI and who had been admitted to our institution's ED were enrolled into this study.

**Results:** The incidence of AMI for individuals who were  $\leq 45$  years old was approximately 12.3% of those admitted to hospital under the impression of AMI. The percentage of males was more predominant in the younger-aged group ( $p < 0.01$ ). Regarding major risk factors for coronary artery disease (CAD), younger patients were more likely to have a family history of cardiac disease ( $p < 0.01$ ), obesity with an elevated body mass index ( $26.2 \pm 4.1$  vs.  $24.2 \pm 3.7$ ,  $p < 0.01$ ), and hyperlipidemia ( $p < 0.01$ ) when compared to the older-aged patients, who were more likely to suffer from hypertension ( $p < 0.01$ ) and/or diabetes mellitus than their younger-aged counterparts ( $p < 0.01$ ). Younger patients also featured a higher incidence of single-vessel CAD ( $p = 0.05$ ), an insignificant rate of CAD ( $p = 0.02$ ), and a lower rate of triple-vessel CAD ( $p = 0.03$ ).

**Conclusion:** For Chinese, male gender and incidences of chest pain, positive family history of heart disease, obesity and hyperlipidemia were significantly greater in the younger-aged AMI patient group than in the older-aged AMI patient group. Younger-aged patients also had a greater rate of single-vessel CAD but a lower rate of triple-vessel CAD than older-aged patients. [*J Chin Med Assoc* 2006;69(11):517–522]

**Key Words:** acute myocardial infarction, emergency department, young adult

## Introduction

In the majority of developed countries, acute myocardial infarction (AMI) is a major cause of death, disability, lost productivity, and reduced quality of life in adults.<sup>1</sup> Approximately 1.5 million Americans sustain myocardial infarction (MI) each year, of whom 6–10% are under the age of 45 years.<sup>1</sup> A number of published studies have reported that individual factors including smoking, diabetes mellitus, hypertension, hyperlipidemia, obesity, and a family history of cardiac disease

contribute to the suite of major risks for AMI in younger-aged patients.<sup>1,2</sup>

The incidence of AMI in Chinese would appear to be roughly 1/8 to 1/4 of the corresponding average Western-country figures.<sup>3</sup> The potential for different risk factors for coronary artery disease (CAD) to exist in younger- compared to older-aged patients who have experienced new-onset AMI remains to be elucidated. To the best of our knowledge and at the time of writing, there are very few articles in the literature that highlight the differences between younger and

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older Chinese patients suffering AMI in terms of their clinical presentation. The purpose of this study was to investigate the differences in the clinical characteristics of Chinese younger- and older-aged AMI adult patients presenting to the emergency department (ED).

## Methods

A retrospective study of adult patients presenting with AMI to the ED of Taipei Veterans General Hospital between January 1996 and June 2003 inclusive was conducted. A total of 2,858 cases of MI, including 201 patients  $\leq 45$  years old and 2,657 patients  $> 45$  years old, were found by way of a computer search of hospital-discharged patients who featured an ICD code of 410.01-410.09 for MI or ischemia. Only patients who featured a diagnosis of AMI upon presentation and who were admitted to our hospital via the ED were enrolled into this study. Subsequent to a medical chart review of retrospective study participants, 134 individuals from the 201 younger-aged patients ( $\leq 45$  years old) were selected for study participation, as were 238 patients collected from a pool of 664 older-aged patients ( $> 45$  years) who had been randomized from the 2,657 elderly patients.

The diagnosis of AMI for the purposes of this study was made based on a combination of at least 2 of the following criteria: (1) a characteristic clinical history associated with MI, such as typical MI chest pain at rest, and which lasted  $\geq 30$  minutes; (2) a series of changes to the normal electrocardiogram (ECG) pattern suggesting MI or some related injury; (3) an increase in serum creatine kinase (CK) of twice the normal level, with a positive MB fraction or troponin I.<sup>4</sup> The exclusion criteria were: (1) a history of prior MI; (2) severe skeletal muscle damage and/or trauma; (3) previous cardiac resuscitation, infectious disease, or signs of cardiac inflammation; (4)  $\leq 15$  years old or non-Chinese.

Patients were categorized into 1 of 2 study groups, younger ( $\leq 45$  years old) and older ( $> 45$  years old).<sup>1</sup> From a comprehensive review of the medical charts of the study participants, patient clinical characteristics, including demographic data, known medical risk factors for CAD,<sup>1</sup> presence of any predisposing systemic illnesses, initial signs and symptoms of AMI, relevant laboratory test results, specific location of MI, and medication administered, were compared between the 2 patient groups.

SPSS version 10.0 (SPSS Inc., Chicago, IL, USA) for Windows was used for data analysis. Intergroup categorical variables were compared using the  $\chi^2$  test or

Fisher's exact test for qualitative data, and the unpaired Student's *t* test for quantitative data. When applicable, tests were 2-tailed, and a *p* value of less than 0.05 was considered to represent statistically significant difference between test groups.

## Results

A total of 372 patients, including 134 younger- and 238 older-aged patients who visited the ED of our institution in the period January 1996 to June 2003 inclusive, with a diagnosis of AMI were identified from their medical charts. The incidence of AMI in individuals  $\leq 45$  years old was about 12.3% in our study.

All study patients' ED charts and hospital admission records were reviewed. Table 1 presents a summary of the relevant demographic data, major risk factors, and systemic illnesses of all patients from both study groups. Among all the patients with AMI, males were predominant, especially in the younger-aged group (94.7% *vs.* 84.9%,  $p < 0.01$ ). Regarding the major risk factors for CAD, younger patients were more likely to have: (1) a family history of CAD ( $p < 0.01$ ); (2) a level of obesity with a greater-than-normal body mass index ( $26.2 \pm 4.1$  *vs.*  $24.2 \pm 3.7$ ,  $p < 0.01$ ); (3) hyperlipidemia ( $p < 0.01$ ). Our study found that patients with diabetes mellitus in both age groups had a significant lower rate of chest pain at presentation for AMI ( $p < 0.01$ ).

As shown in Table 2, younger patients were more likely to present with typical signs and symptoms of MI such as chest pain and cold sweating than were older patients ( $p < 0.01$ ), but younger patients did not demonstrate any significant difference as to the specific location of radiating pain when compared with older patients. Consistent with a higher ratio of hyperlipidemia in younger compared to older patients (Table 1), younger patients exhibited a higher serum total cholesterol level than did older patients ( $209.2 \pm 53.9$  *vs.*  $188.0 \pm 52.8$ ,  $p < 0.01$ ), the same was found for serum low-density lipoprotein (LDL) ( $139.0 \pm 39.7$  *vs.*  $116.4 \pm 34.7$ ,  $p < 0.01$ ) and serum triglycerides ( $221.2 \pm 173.7$  *vs.*  $128.9 \pm 89.7$ ,  $p < 0.01$ ). Conversely, serum high-density lipoprotein (HDL) levels were lower in younger-aged patients than in their older counterparts ( $37.6 \pm 9.3$  *vs.*  $41.8 \pm 1.3$ ,  $p = 0.05$ ). Peak CK and MB levels for the 2 study groups proved to be not significantly different.

In total, 82.5% of patients underwent coronary angiography subsequent to their MI attack, 90.3% for the younger-aged group, and 78.2% for the older-aged group ( $p < 0.01$ ). The culprit lesion for the MI

**Table 1.** Comparison of demographic data, major risk factors and systemic diseases between the 2 patient groups

	Younger ( <i>n</i> = 134) <i>n</i> (%)	Older ( <i>n</i> = 238) <i>n</i> (%)	<i>p</i>
Age	40.1 ± 4.9	68.9 ± 10.5	<0.01
Male:Female	94.8 (127:7)	84.9 (202:36)	<0.01
Major risk factors			
Family history* of CAD	88 (65.2)	52 (21.8)	<0.01
Smoking	97 (71.9)	157 (66.0)	NS
HTN	46 (34.1)	158 (66.4)	<0.01
DM	28 (20.7)	74 (31.1)	<0.01
Obesity <sup>†</sup>	22 (16.4)	16 (6.7)	<0.01
Hyperlipidemia	83 (61.5)	81 (34.0)	<0.01
Systemic illnesses			
CAD	18 (13.4)	63 (26.4)	<0.01
Cerebral vascular disease	2 (1.5)	38 (16.0)	<0.01
Hyperuricemia (gout)	18 (13.3)	18 (7.6)	NS
Liver disease	11 (8.1)	5 (2.1)	<0.01
Renal disease or stone	14 (10.4)	40 (16.8)	NS
Pulmonary disease	1 (0.7)	19 (8.1)	<0.01
Hyperthyroidism	1 (0.7)	5 (2.1)	NS
PAOD	1 (0.7)	9 (3.8)	NS
CHD	1 (0.7)	4 (1.7)	NS
Valvular heart disease	1 (0.7)	4 (1.7)	NS
Malignancy	1 (0.7)	10 (4.2)	0.02
CABG surgery	0 (0)	5 (2.1)	NS
Hypothyroidism	0 (0)	2 (0.8)	NS
Arrhythmia	0 (0)	10 (4.2)	NS

\*Family history indicates first-degree relative; <sup>†</sup>obesity defined as body mass index  $\geq 30$  (calculated as body weight in kg divided by height in meters squared). CAD = coronary artery disease; HTN = hypertension; DM = diabetes mellitus; PAOD = peripheral artery occlusion disease; CHD = congestive heart disease; CABG = coronary artery bypass graft; NS = not significant.

was diagnosed by coronary angiography when the coronary artery was narrowed >70%, which corresponded to the location of the AMI.<sup>5</sup> Younger patients had a higher rate of single-vessel CAD (SVD) ( $p=0.05$ ) and also of insignificant CAD ( $p=0.02$ ), but a lower rate of triple-vessel CAD (TVD) than older-aged patients ( $p=0.03$ ). Incidence of lesions of the left anterior descending coronary artery (LAD) for younger- and older-aged patients were 66.9% and 82.8% ( $p<0.01$ ), respectively, and lesions of the left circumflex coronary artery (LCX) were 42.1% and 60.2% for younger and older patients, respectively ( $p<0.01$ ) (Table 3). Younger patients had a lower rate of mortality than older patients (2.2% *vs.* 11.9%,  $p<0.01$ ). In both younger- and older-aged groups, there was no correlation between hypertension and LAD stenosis ( $p<0.05$ ). In the younger patient group, diabetes mellitus was correlated with LAD stenosis ( $p<0.05$ ) and TVD ( $p<0.05$ ). In the older patient group, diabetes mellitus correlated with LCX stenosis ( $p<0.05$ ), SVD ( $p<0.05$ ) and TVD ( $p<0.05$ ).

## Discussion

MI in younger patients is a relatively small proportion of all MIs, but the personal and social burdens are substantial. Studies in the 1970s and 1980s suggested that approximately 2–6% of all MIs occurred in younger patients.<sup>6</sup> This had risen to 10% in the 1990s, and to 12.3% in this study of the period 1996–2003. As in previous studies,<sup>2,7,8</sup> we also found that male gender was more predominant in younger-aged than in older-aged patients.

Chest pain, the most frequent symptom of MI, is typically a significant symptom of AMI in young adult patients.<sup>9–11</sup> In contrast to this, “silent” MI tends to be more frequent in older than in younger patients.<sup>12</sup> In this study, we noted a negative correlation between diabetes mellitus and chest pain; such an outcome may perhaps be due to the presence of diabetic cardiovascular autonomic neuropathy in older patients.<sup>13</sup> The relative significance of elevated serum triglyceride and LDL levels and diminished HDL levels as constituting

**Table 2.** Comparison of clinical signs and symptoms and laboratory tests between the 2 patient groups

	Younger (n = 134)	Older (n = 238)	p
Signs and symptoms, n (%)			
Chest pain	132 (98.5)	216 (90.8)	0.01
Cold sweating	104 (77.6)	161 (67.7)	0.04
Radiation pain	61 (45.2)	94 (39.5)	NS
Dyspnea	46 (34.1)	109 (45.8)	0.04
Nausea or vomiting	27 (20.0)	56 (23.5)	NS
Dizziness	19 (14.1)	33 (13.9)	NS
Loss of consciousness	11 (8.1)	19 (8.0)	NS
Palpitation	7 (5.2)	14 (5.9)	NS
Orthopnea	4 (3.0)	7 (3.0)	NS
Shock	3 (2.2)	2 (0.8)	NS
Headache	2 (1.5)	6 (2.5)	NS
Laboratory tests*			
Cholesterol (mg/dL)	209.2 ± 53.9	188.0 ± 52.8	<0.01
LDL (mg/dL)	139.0 ± 39.7	116.4 ± 34.7	<0.01
HDL (mg/dL)	37.6 ± 9.3	41.8 ± 16.0	0.05
TG (mg/dL)	221.2 ± 173.7	128.9 ± 89.7	<0.01
TC/HDL	6.0 ± 2.1	4.8 ± 1.3	<0.01
Peak CK (mg/dL)	2,071.2 ± 1,943.8	1,771.5 ± 2,508.8	NS
Peak CK-MB (mg/dL)	172.5 ± 156.9	161.9 ± 167.6	NS
Glucose (mg/dL)	147.2 ± 73.2	183.6 ± 105.8	<0.01

\*Data are expressed as mean ± standard deviation. LDL = low-density lipoprotein; HDL = high-density lipoprotein; TG = triglycerides; TC = total cholesterol; CK = creatine kinase; NS = not significant.

**Table 3.** Locations of myocardial infarction in the 2 patient groups

	Younger (n = 134) n (%)	Older (n = 238) n (%)	p
Ejection fraction*	47.6 ± 14.8	45.3 ± 14.1	NS
Coronary angiography	121 (90.3)	186 (78.2)	<0.01
SVD	50 (41.3)	56 (30.1)	0.05
DVD	29 (24.0)	54 (29.0)	NS
TVD	31 (25.6)	71 (38.2)	0.03
Insignificant CAD	11 (9.1)	5 (2.7)	0.02
RCA	69 (57.0)	112 (60.2)	NS
LAD	81 (66.9)	154 (82.8)	<0.01
LCX	51 (42.1)	112 (60.2)	<0.01

\*Data are expressed as mean ± standard deviation. SVD = single-vessel coronary artery disease; DVD = double-vessel coronary artery disease; TVD = triple-vessel coronary artery disease; CAD = coronary artery disease; RCA = right coronary artery; LAD = left anterior descending coronary artery; LCX = left circumflex coronary artery; NS = not significant.

independent CAD risk factors in younger adults has been well established.<sup>14-17</sup> Our study found significantly greater serum triglyceride, LDL, and total cholesterol levels as well as a significantly greater ratio of serum total cholesterol/HDL in younger patients. Castelli et al stressed the importance of the total cholesterol/HDL ratio for assessing an individual's risk for coronary heart disease amongst younger adults, particularly for those with a greater-than-normal range of blood cholesterol.<sup>18</sup>

Cigarette smoking is one of the known major coronary risk factors in younger MI patients.<sup>8</sup> From the results of various Western studies, the rate of smoking in younger MI patients appear to lie in the range of about 76-91%, compared with a corresponding figure of approximately 40% for older-aged patients.<sup>7,9,12</sup> Smoking has been reported to be an independent but significant risk factor for CAD in Denmark.<sup>19</sup> In our study, the rate of smoking in older patients was around 66%, a much higher rate than in the

West; smoking was also a risk factor for the younger MI patients, for whom the rate of smoking was 71.9% in our study. A positive family history of CAD has often been reported to be another major risk factor for AMI amongst younger patients in the West.<sup>8,20</sup> The prevalence of a family history of CAD was about 65.2% in our younger-aged group, and such a figure is consistent with corresponding results from recent studies.<sup>6,8</sup>

Obesity is another major risk factor for CAD, with 1 study reporting that approximately 30–58% of younger-aged patients suffering from CAD were obese.<sup>14</sup> In our study, the rate of obesity amongst the younger-aged patients was only about 16.4%, a much lower figure than in the West.<sup>14</sup> Nevertheless, despite this, the 16.4% rate of obesity in younger-aged patients is significantly higher than the 6.7% rate in the older-aged patients. Thus, although there is a substantially lower prevalence of obesity in Oriental compared to Western societies, obesity is a significant risk factor for younger-aged Oriental MI patients.

Hypertension and diabetes mellitus are more likely to be associated with MI in older-aged patients than in younger-aged patients.<sup>1,21–24</sup> Approximately 14–30% of younger-aged patients suffering from MI have a history of hypertension, and <10% of such individuals suffered from diabetes, as revealed by the results of studies conducted during the 1970s and 1980s.<sup>14</sup> Crittin et al reported that hypertension was common in young patients with LAD stenosis.<sup>25</sup> In our study, we observed a greater rate of hypertension (34.1%) amongst younger-aged patients than appears to be the case in a number of previous studies, although we observed no correlation between hypertension and LAD stenosis for both the younger- and older-aged patient groups. Our study found a higher rate of diabetes mellitus (20.7%) in younger-aged MI patients than in previous studies.<sup>14</sup> The rate of diabetes mellitus correlated significantly with the rate of LAD stenosis and TVD amongst the younger-aged patients in this study. For the older-aged patient group, the rate of diabetes mellitus correlated significantly with LCX stenosis, SVD, and TVD. Diabetes mellitus appeared to have a more important role than hypertension in younger-aged MI patients.

Previous reports have noted both favorable short- and long-term prognoses for younger patients with MI<sup>12,26–28</sup> compared to older patients because they have less extensive coronary atherosclerosis.<sup>29,30</sup> An AMI located in the anterior wall, previous AMI and, in particular, a depressed ejection fraction were all significant features that predicted a poor long-term prognosis.<sup>31</sup> However, the long-term mortality rate was

lower in patients who had received thrombolytic therapy or revascularization than in those who had not, possibly due to early restoration of vessel patency. Previous studies have pointed out the importance of vessel patency as a long-term prognostic factor.<sup>32</sup>

There were some notable limitations to this study. First, in retrospective studies, selection and recall biases tend to be potential problems. For our study, we included only MI survivors who had presented to the ED of our institution; thus, suspected MI patients who died prior to arriving at our hospital were not included in the study. Second, although younger-aged MI patients presenting at our institution are usually referred for cardiac catheterization, some patients did not consent to the procedure. Third, a higher percentage of AMI in older-aged patients who had culprit lesions in both LAD and LCX was noted. This may be due to the fact that only 78% of older-aged patients received cardiac catheterization. Hence, we cannot exclude the possibility that our results would be somewhat different if all younger survivors of infarction had undergone catheterization.

In conclusion, male gender, chest pain, positive family history of CAD, obesity and hyperlipidemia are predominant factors in Chinese younger patients suffering from MI, as appears also to be the case in Western populations. However, we found a higher rate of smoking in both our younger and older MI patients than in the West. Younger-aged MI patients featured more substantial rates of SVD as well as lower rates of TVD than older-aged patients. Only diabetes mellitus had a positive correlation with TVD in both younger- and older-aged patients. Diabetes mellitus has a more important role than hypertension with regard to the risk of MI in both age groups in this study.

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