Acute Coronary Syndrome in Young Adults: The Thai ACS Registry

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Background: *There are few data regarding acute coronary syndrome (ACS) in young adults. ACS in young adults may have some characteristics that are different from those in older patients.*
Objective: *The purpose of the present study was to assess the frequency, risk factors, presenting symptoms, treatment, complications and in-hospital outcomes of young patients with ACS in Thailand compared with those of older patients.*
Material and Method: *From the Thai ACS registry database of 9,373 consecutive patients admitted to participating hospitals between August 1, 2002 and October 31, 2005, the authors divided patients into three age categories: < 45 years, 45-54 years and > 54 years. Risk factors, presenting symptoms, type of ACS, management, complications and in-hospital outcomes of the 3 age groups were analyzed.*
Results: *Young patients comprised of 5.8% (544 patients) of all ACS patients. Discharge diagnosis in the young group was ST segment elevation myocardial infarction (STEMI) in 67%, non-ST segment elevation myocardial infarction (NSTEMI) 20% and unstable angina 14%. The young patients were more likely to have an STEMI than their elder counterparts. Risk factors such as tobacco use and a family history were more frequent in the young patients, whereas diabetes and hypertension were less frequent. Importantly, 66% of the patients aged <45 years had a history of tobacco use. A higher percentage of the young patients underwent coronary angiography, percutaneous coronary intervention and received aspirin, thienopyridines, GP IIb/IIIa antagonists, beta-blockers and statins. In STEMI patients, reperfusion therapy was given more frequently in the patients aged < 45 years. Younger patients had a lower in-hospital mortality rate, lower incidence of congestive heart failure and a shorter length of stay. Multivariable analysis of in-hospital mortality revealed that older age remained an independent predictor of death.*
Conclusion: *In Thailand, 5.8% of patients with ACS are under the age of 45 years old. The frequency of risk factors in the young patients differs from those in their elderly counterparts. The current management and aggressive risk factor modification are quite good and the overall mortality is lower in young adults with ACS compared to their elder counterparts. Primary preventive measures aimed at preventing our youth from adopting tobacco use should be implemented nationally.*

Keywords: *Acute coronary syndrome, Acute myocardial infarction, Young adults*

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The majority of acute coronary syndromes (ACS) occur in individuals > 45 years old. However, 5-10% of myocardial infarctions (MI) occur in patients younger than 46 years old[1-5]. Although MI's in younger patients are generally associated with a favorable prognosis[2,4,5], the personal and societal burden of premature coronary disease is substantial. The occurrence of ACS in a young person leads to premature morbidity

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and mortality in what should be the most productive years of life.

Previous studies have found MI in younger adults to be more likely associated with a history of smoking[2-4,6], hypercholesterolemia[3,6,7], a family history[2,4] and less likely to have a history of preceding angina[2,7]. Angiographically, normal or minimal lesion coronary anatomy was more frequently found in the younger patients[4,6,7].

Certain ethnic groups may have higher risks of cardiovascular disease than others[8]. In Thailand, ACS in young adults has not been extensively studied[5]. Thus, the Thai ACS registry provides a unique contemporary database to study the epidemiologic profile of young patients in Thailand.

In the present study, the authors divided the patients enrolled in the Thai ACS registry into three age categories, those < 45 years old, those 45-54 years old and those > 54 years old. With a goal to determine the proportion of young adults with ACS and to provide an overview of differences and similarities in frequency, characteristics, management and in-hospital outcomes of very young adults compared to their older counterparts with ACS in Thailand. These results may have direct implications for future primary and secondary prevention strategies in patients at risk for premature coronary disease.

Material and Method

The Thai ACS registry is a national, multicenter, prospective registry. Sixteen institutions across the country (comprised of 10 Bangkok academic hospitals, three regional academic hospitals and four private hospitals) participated. Patients who presented within 14 days of chest pain or other symptoms suggestive of ACS were prospectively and consecutively enrolled. Data from 9,373 patients with ACS who were admitted to a participating hospital between August 1, 2002 and October 31, 2005, were collected. In the current study, the authors divided the patients enrolled in the Thai ACS registry into three age categories, those < 45 years old, those 45-54 years old and those > 54 years old.

Patients were diagnosed with one of the following 1) ST segment elevation MI (STEMI) 2) Non-ST segment elevation MI (NSTEMI) 3) Unstable angina with ST-T wave changes. STEMI was diagnosed by having elevated biochemical markers of myocardial necrosis and ECG changes demonstrating either: 1) ST-segment elevation ≥ 1 mm in two consecutive leads or 2) new or presumed new left bundle branch block. NSTEMI was determined by elevated biochemical markers of myocardial necrosis and either: 1) ischemic symptoms compatible with ACS or 2) ST-segment depression or T wave abnormalities. Unstable angina was defined as ischemic symptoms compatible with ACS and ST-segment depression or T wave abnormalities.

Data collection

Patient's clinical, demographics, treatments and outcome data were collected by trained cardiac nurses and transcribed onto standard data forms and web-base data entry forms.

Demographic variables included gender and age. Dyslipidemia, diabetes, hypertension, history of tobacco use and family history were used to characterize risk factors. Diabetes was diagnosed when fasting plasma glucose was 126 mg/dL or higher on at least two occasions or the presence of a history of diabetes treated either with dietary control or antidiabetic medication. Hypertension was defined as systolic blood pressure > 140 mmHg or diastolic blood pressure > 90 mmHg or a previous diagnosis of hypertension. Dyslipidemia was diagnosed when total cholesterol was > 200 mg/dL, LDL cholesterol > 130 mg/dL, HDL cholesterol < 40 mg/dL or a previous diagnosis of dyslipidemia and/or currently being treated with a lipid lowering agent. Tobacco use was defined by the habitual use of tobacco within two years of index hospital admission. Presenting symptoms were recorded as typical angina, atypical angina, dyspnea, cardiogenic shock, and/or cardiac arrest. Reperfusion strategy in STEMI included use of thrombolytic therapy, primary percutaneous coronary intervention (PCI) or coronary artery bypass graft surgery (CABG). Procedural data included coronary angiography, CABG and PCI. Medical management included the use of aspirin, thienopyridine, heparin, low-molecular weight heparin, GP IIb/IIIa antagonist, angiotensin-converting enzyme inhibitor, beta-blockers, calcium channel blocker, angiotensin receptor blocker, nitrates and statins. In-hospital complications included major bleeding, congestive heart failure, cardiogenic shock, ischemic and hemorrhagic stroke, arrhythmias and death. Cardiac arrhythmia was classified as heart block (at least 2nd degree AV block) or ventricular arrhythmia (either sustained ventricular tachycardia or ventricular fibrillation). In-hospital death was categorized as cardiac or non-cardiac death.

This protocol was approved by the hospital ethics committee of each participating hospital and is in accordance with the Declaration of Helsinki. Informed consent was obtained from every patient.

Statistical analysis

Categorical variables were described as frequency and percentages. Continuous variables were presented as mean ± standard deviation or median (minimum and maximal) or interquartile range as appropriate. Association between risk factors and age groups was assessed by using Chi-square test. Kruskal-Wallis one-way analysis of variance was used testing equality of population medians among three age groups. Multiple Logistic regression analyses were used to adjust for factors influencing in-hospital death. The following variables were examined: diabetes mellitus, use of aspirin, thienopyridine, beta-blocker, angiotensin-receptor blocker, lipid lowering agent, calcium channel and age group. All statistical tests were 2-tailed with p-value < 0.05 considered statistically significance. Statistical analysis was performed using STATA version 8 (Stata Corp, College Station, Texas).

Results

The 9,373 patients were divided into three categories by age: < 45 years, 45-54 years and > 54 years. Fig. 1 illustrates the age distribution of the total ACS patient population. Five hundred and forty four (5.8%) patients were less than 45 years old and the majority (78%) was over 54 years old. The youngest patient in the study was 22.8 years old and the oldest was 105.5 years old. All age groups were predominantly male with a higher proportion of males in the young group (Table 1).

Risk factors differed significantly among the three age groups (Table 1). In patients < 45 years old

Table 1. Risk factors for acute coronary syndrome according to age group

Characteristics	< 45 y n = 544, n (%)	45-54 y n = 1,518, n (%)	> 54 y n = 7,311, n (%)	p-value
Gender (male)	464 (85.3)	1,146 (75.5)	3,995 (54.6)	<0.001
Diabetes	118/536 (22.0)	572/1,494 (38.3)	3,380/7,181 (47.1)	<0.001
Hypertension	163/534 (30.5)	769/1,506 (51.1)	5,005/7,247 (69.1)	<0.001
Dyslipidemia	393/508 (77.4)	1,110/1,441 (77.0)	5,064/6,765 (74.9)	0.123
Tobacco use	353/536 (65.9)	744/1,480 (50.3)	1,826/7,122 (25.6)	<0.001
Family history	112/475 (23.6)	228/1,300 (17.5)	533/5,988 (8.9)	<0.001

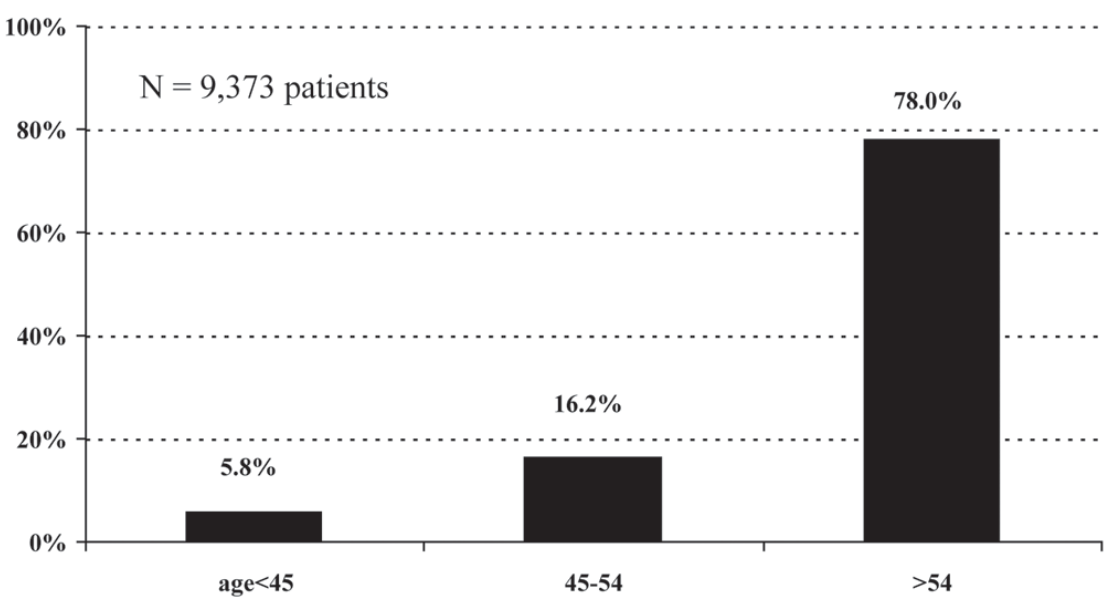

Fig. 1 Age distribution of total acute coronary syndrome patients

66% were smokers and this percentage decreased with increasing age ($p < 0.001$). Younger patients were more likely to have a family history of coronary disease ($p < 0.001$) and were less likely to have diabetes or hypertension ($p < 0.001$).

Presenting symptoms are illustrated in Table 2. Younger patients were more likely to present with typical angina ($p < 0.001$). There were no differences in the percentage of patients who presented with cardiogenic shock or syncope, however, the overall numbers were small.

Younger patients were more likely to have an STEMI (Fig. 2). The incidence of STEMI in patients < 45 years, 45-54 years and > 54 years old were 67.3%, 54.9% and 36.0% respectively. Among young patients, rates of STEMI, NSTEMI and UA were 67.3%, 19.3% and 13.4% respectively.

Pharmacological treatment is shown in Table 3. Patients < 45 years old were more likely to receive aspirin, thienopyridine, GP IIb/IIIa antagonists, beta-blockers and statins, whereas they were less likely to receive nitrates and calcium channel blockers. There were no significant differences in the use of heparin, low-molecular weight heparin and ACE inhibitors across all age categories.

When invasive diagnostic and therapeutic procedures were analyzed (Table 4), coronary angiography and PCI were preformed more frequently ($p < 0.001$) in patients aged < 45 years old, whereas CABG was performed less frequently ($p = 0.01$). Importantly, non-significant CAD was found more frequently in the younger patients ($p = 0.001$).

Table 2. Presenting symptoms according to age group

Symptoms	< 45 y n = 544, n (%)	45-54 y n = 1,518, n (%)	> 54 y n = 7,311, n (%)	p-value
Typical angina	402/466 (86.3)	1,103/1,283 (85.9)	4,641/6,069 (76.5)	<0.001
Atypical angina	42/466 (9.0)	130/1,283 (10.1)	826/6,069 (13.6)	<0.001
Chest pain	519/544 (95.4)	1,450/1,518 (95.5)	6,520/7,311 (89.2)	<0.001
Dyspnea	56/394 (14.2)	208/1,103 (18.9)	1,841/5,333 (34.5)	<0.001
Cardiogenic shock	41/544 (7.5)	131/1,518 (8.6)	699/7,311 (9.6)	0.182
Cardiac arrest	34/544 (6.3)	80 /1,518 (5.3)	281/7,311 (3.8)	0.002
Syncope	14/316 (4.4)	55/868 (6.3)	212/4,091 (5.2)	0.297

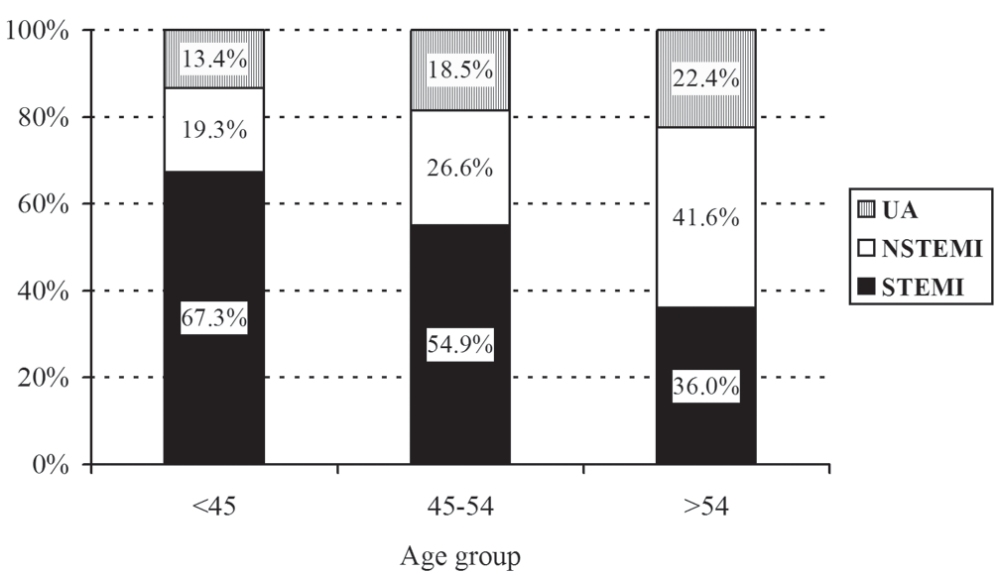

Fig. 2 Diagnosis according to age group

Table 3. Pharmacological treatment

Treatment	< 45 y n = 544, n (%)	45-54 y n = 1,518, n (%)	> 54 y n = 7,311, n (%)	p-value
ASA	534 (98.2)	1,478 (97.4)	6,868 (93.9)	<0.001
GP IIb/IIIa inhibitor	97 (17.8)	222 (14.6)	681 (9.3)	<0.001
Heparin	132 (24.3)	355 (23.4)	1,679 (23.0)	0.756
LMWH	292 (53.7)	905 (59.6)	4,548 (62.2)	<0.001
Ca++ blocker	56 (10.3)	226 (14.9)	1,629 (22.3)	<0.001
Nitrate	432 (79.4)	1,295 (85.3)	6,122 (83.7)	0.006
Beta-blocker	393 (72.2)	1,068 (70.4)	4,392 (60.1)	<0.001
ACEI	318 (58.5)	920 (60.6)	4,178 (57.2)	0.043
ARB	19 (3.5)	86 (5.7)	633 (8.7)	<0.001
ACEI + ARB	332 (61.03)	977 (64.36)	4,601 (62.93)	0.347
Statin	445 (81.8)	1,284 (84.6)	5,760 (78.8)	<0.001
Other lipid lowering agents	24 (4.4)	64 (4.2)	273 (3.7)	0.528
ADP inhibitor	346 (63.6)	949 (62.5)	4,162 (56.9)	<0.001

LMWH = low molecular weight heparin, ACEI = angiotensin converting enzyme inhibitor, ARB = angiotensin receptor blocker

Table 4. Coronary angiogram and revascularization

Angiogram	< 45 y n = 544, n (%)	45-54 y n = 1,518, n (%)	> 54 y n = 7,311, n (%)	p-value
Coronary angiogram	350 (64.3)	916 (60.3)	3,616 (49.5)	<0.001
Patients with significant CAD	317 (90.6)	866 (94.5)	3,459 (95.7)	<0.001
CABG	22 (4.0)	89 (5.9)	515 (7.0)	0.010
PCI	228 (41.9)	593 (39.1)	2,006 (27.4)	<0.001

CAD = coronary artery disease, CABG = coronary artery bypass graft surgery, PCI = percutaneous coronary intervention

When the analysis was limited to the STEMI patients, there was no difference in the median time from symptom onset to hospital presentation (Table 5) among the age groups. Reperfusion therapy in the STEMI patients according to age group is demonstrated in Table 5. The patients aged < 45 years tended to receive primary PCI ($p = 0.438$) or fibrinolytic therapy more frequently ($p < 0.001$).

In-hospital mortality (Table 6) was lower in the younger group ($p < 0.001$). These differences in mortality were due to a lower incidence of both cardiac and non-cardiac deaths in the younger group. On multivariable analysis of in-hospital mortality (Table 7), age > 54 years old remained an independent predictor of death.

While congestive heart failure incidence increased with increasing age, patients aged < 45 years had the lowest incidence (< 0.001). There was a trend toward a lower incidence of stroke and major bleeding in the youngest group. Length of stay was lowest in the youngest group and increased with advancing age (Table 6).

Discussion

The current study indicates that 5.8% of all Thai ACS patients are younger than 45 years old. These findings are in accordance with previous studies that have estimated that 5-10% of myocardial infarctions (MI) occur in patients younger than 46 years old[1-6]. The young patients in the present study were predominantly males with females comprising of 14.7% of all patients < 45 years. Sex distribution followed a similar pattern observed in previous studies[2,6].

Cigarette smoking was an important cardiovascular risk factor that was inversely related to age. Up to 66% of the presented young patients reported a history of smoking. Alarmingly, the frequency of tobacco use in these patients doubled those in their

Table 5. STEMI patients

STEMI patients	< 45 y n = 366, n (%)	45-54 y n = 834, n (%)	> 54 y n = 2,636, n (%)	p-value
Time to admission (hours), Median (IQR)	5.3 (2:21.3)	6.5 (2.5:30.8)	7.5 (2.9:32.5)	<0.001
Thrombolytic therapy	137 (37.4)	298 (35.7)	730 (27.7)	<0.001
Primary PCI	89/270 (33.0)	192/609 (31.5)	572/2,066 (27.7)	0.058
Emergency CABG	9/360 (2.5)	14/803 (1.7)	71/2,537 (2.8)	0.253

CABG = coronary artery bypass graft surgery, PCI = percutaneous coronary intervention, IQR = inter quartile range

Table 6. In-hospital outcome

Outcome	< 45 y n = 544, n (%)	45-54 y n = 1,518, n (%)	> 54 y n = 7,311, n (%)	p-value
Congestive heart failure	139 (25.6)	501 (33.0)	3,588 (49.1)	<0.001
Cardiogenic shock (killip 4)	41/446 (9.2)	128/1,145 (11.2)	796/4,519 (17.6)	<0.001
Cardiac arrhythmia	107 (19.7)	256 (16.9)	1,194 (16.3)	0.125
Stroke	7 (1.3)	27 (1.8)	151 (2.1)	0.379
- Ischemic stroke	2 (0.9)	14 (2.2)	46 (1.4)	
- Hemorrhagic stroke	1 (0.4)	1 (0.2)	6 (0.2)	
Major bleeding	14 (2.6)	65 (4.3)	478 (6.5)	<0.001
Death	40 (7.4)	109 (7.2)	1,029 (14.1)	<0.001
- Cardiac death	37 (6.8)	91 (6.0)	792 (10.8)	
- Noncardiac death	3 (0.6)	18 (1.2)	237 (3.2)	
Length of stay (day), Median (IQR)	5.0 (3.0:8.2)	5.9 (3.6:9.8)	7.1(4.0:12.8)	<0.001

IQR = inter quartile range
CHF = congestive heart failure

Table 7. Multivariate logistic regression analysis of in-hospital mortality

Age group	Mortality rate (%)	Crude OR (95% CI)	Adjusted OR (95% CI)
Age < 45 y	7.4	1	1
Age 45-54 y	7.2	0.98 (0.67-1.42)	1.03 (0.64-1.67)
Age > 54 y	14.1	2.06 (1.49-2.87)	1.78 (1.16-2.74)

Adjusted for variables that Stepwise Multiple Logistic regression p-remove $\geq$ 0.2 and p-enter < 0.1: Gender, chest pain, shock, post cardiac arrest, diabetes mellitus, hypertension smoking, dyslipidemia, ASA, beta-blocker, calcium antagonist, statin, angiotensin converting enzyme inhibitor, thienopyridine, GP IIb/IIIa antagonist, coronary angiogram, thrombolysis, percutaneous coronary intervention, coronary artery bypass graft surgery, congestive heart failure, arrhythmia, stroke, bleeding

older counterparts. Similarly, several studies found an exceedingly high rate of tobacco use among young patients with AMI ranging from 70% to > 90%[2-4,6,7,10]. The Results of the Bogalusa Heart Study[11] showed that the extent of fatty-streak lesions in the coronary arteries of young adults was higher in smokers than in nonsmokers. Thus, the present findings stress the importance of identifying smoking as a major risk

factor that is modifiable and should be aggressively targeted. Consistent with other reports in young AMI patients, is a common family history of coronary artery disease and lower prevalence of diabetes and hypertension[2,4,6,12,13].

The findings from the present study regarding the type of ACS are similar to those published previously[6,10]. STEMI was more frequent in the young patients, whereas NSTEMI was in the elderly. These findings support the suggestion that the pathophysiology in these two types of ACS may differ.

Overall, medical therapy and risk factor modification for the presented young patients with ACS were quite good and better than in the older patients. A high percentage of patients received aspirin, beta-blockers and statins. The use of ACEI was somewhat low at 58.5% and should be considered an opportunity for improving care, particularly in patients with heart failure or left-ventricular dysfunction[14,15]. Overall use of GPIIb/IIIa inhibitors was low but highest in the young group. These drugs have been shown to lower ischemic events in patients with ACS[16-19].

Coronary angiography and PCI were preformed more frequently in patients aged < 45 years old (64.3% and 41.9%, respectively). These practices are in concordance with those previously reported[2,6]. PCI in young adults[20,21] has been reported to have a favorable short- and long-term outcome compared with older patients. These procedures result in excellent alleviation of symptoms but must be performed in combination with aggressive risk factor modification.

Angiographically, the authors found normal or minimal lesion coronary anatomy more frequently in the younger patients and consistent with others[4-7,22]. The mechanism leading to ACS in patients with insignificant coronary artery disease is not fully understood. Nonatherosclerotic coronary disease should always be considered in a young patient with ACS such as coronary spasm, impaired microvascular perfusion, congenital coronary anomalies, vasculitis and drug effects[23-25].

When the analysis was limited to the STEMI patients, there was no difference in the median time from symptom onset to hospital presentation among the age groups. It is noteworthy that the overall time to presentation is quite long (13.9 hours in the patients < 45 years). Thus, these findings provide an opportunity for improving outcome by executing national campaigns for the general population to recognize symptoms of ACS. Patients aged < 45 years with STEMI tended to receive primary PCI or fibrinolytic therapy more frequently. Fibrinolytic treatment in young adults has been reported to have comparable effects in different age groups[26-27].

The incidence of in-hospital congestive heart failure, stroke and major bleeding were lowest in the youngest age group. The in-hospital mortality rate was lower in the younger patients and increased with advancing age. The advantage of young age in predicting a more favorable in-hospital outcome no longer remained after adjustment for differences in baseline characteristics and medication use. These results are consistent with previous studies[2,4-6,26]. Although the younger ACS patients generally are associated with a favorable short-term prognosis, the personal and societal burden of premature coronary disease is substantial. Thus, preventative measures must be addressed by both patients and physicians in order to decrease long-term morbidity and mortality from coronary artery disease.

Limitations

The majority of participating hospitals were tertiary care hospitals with cardiac catheterization laboratory facilities. Thus, the present findings may not be generalized to patients of other hospital types. The authors report only short-term, in-hospital outcome, which may be inadequate to capture the true burden of premature coronary disease from a personal and societal point of view. Only conventional coronary disease risk factors were identified. Several emerging risk factors such as lipoprotein abnormalities, hypercoagable states, elevated homocysteine levels, markers of inflammation and platelet glycoprotein IIIa PI^{A2} polymorphism[28] were not evaluated. Furthermore, non-atherosclerotic coronary disease, which should be considered in young patients with ACS, were not recorded.

Conclusion

In Thailand 5.8% of patients with ACS were under the age of 45 years old. There were substantial differences in the characteristics of ACS in the young patients compared with those in their elderly counterparts. The current management and aggressive risk factor modification are at acceptable rates and the overall short-term mortality is lower in young adults with ACS compared to their elder counterparts. These findings may allow better risk stratification for future primary and secondary prevention strategies in patients at risk for premature coronary disease.

Contributors

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References

1. Pasricha A, Batchelor W. When young hearts are broken: profiles of premature myocardial infarction. Am Heart J 2002; 143: 4-6.
2. Doughty M, Mehta R, Bruckman D, Das S, Karavite D, Tsai T, et al. Acute myocardial infarction in the young - the University of Michigan experience. Am Heart J 2002; 143: 56-62.
3. Choudhury L, Marsh JD. Myocardial infarction in young patients. Am J Med 1999; 107: 254-61.
4. Zimmerman FH, Cameron A, Fisher LD, Ng G.. Myocardial infarction in young adults: angiographic characterization, risk factors and prognosis (Coronary Artery Surgery Study Registry). J Am Coll Cardiol 1995; 26: 654-61.
5. Chaithiraphan S, Sahasakul Y, Charoenchob N. Acute myocardial infarction in the young. J Med Assoc Thai 1985; 68: 190-7.
6. Avezum A, Makdisse M, Spencer F, Gore JM, Fox KA, Montalescot G, et al. Impact of age on management and outcome of acute coronary syndrome: observations from the Global Registry of Acute Coronary Events (GRACE). Am Heart J 2005; 149: 67-73.
7. Hong MK, Cho SY, Hong BK, Chang KJ, Mo-Chung I, Hyoung-Lee M, et al. Acute myocardial infarction in the young adults. Yonsei Med J 1994; 35: 184-9.
8. Warren SE, Thompson SI, Vieweg WV. Historic and angiographic features of young adults surviving myocardial infarction. Chest 1979; 75: 667-70.
9. Ismail J, Jafar TH, Jafary FH, White F, Faruqui AM, Chaturvedi N. Risk factors for non-fatal myocardial infarction in young South Asian adults. Heart 2004; 90: 259-63.
10. Al Khadra AH. Clinical profile of young patients with acute myocardial infarction in Saudi Arabia. Int J Cardiol 2003; 91: 9-13.
11. Berenson GS, Srinivasan SR, Bao W, Newman WP, III, Tracy RE, Wattigney WA. Association between multiple cardiovascular risk factors and atherosclerosis in children and young adults. The Bogalusa Heart Study. N Engl J Med 1998; 338: 1650-6.
12. Wolfe MW, Vacek JL. Myocardial infarction in the young. Angiographic features and risk factor analysis of patients with myocardial infarction at or before the age of 35 years. Chest 1988; 94: 926-30.
13. Dolder MA, Oliver MF. Myocardial infarction in young men. Study of risk factors in nine countries. Br Heart J 1975; 37: 493-503.
14. Pfeffer MA, Braunwald E, Moye LA, Basta L, Brown EJ Jr, Cuddy TE, et al. Effect of captopril on mortality and morbidity in patients with left ventricular dysfunction after myocardial infarction. Results of the survival and ventricular enlargement trial. The SAVE Investigators. N Engl J Med 1992; 327: 669-77.
15. The Acute Infarction Ramipril Efficacy (AIRE) Study Investigators. Effect of ramipril on mortality and morbidity of survivors of acute myocardial infarction with clinical evidence of heart failure. Lancet 1993; 342: 821-8.
16. The PURSUIT Trial Investigators. Inhibition of platelet glycoprotein IIb/IIIa with eptifibatide in patients with acute coronary syndromes. Platelet Glycoprotein IIb/IIIa in Unstable Angina: Receptor Suppression Using Integrilin Therapy. N Engl J Med 1998; 339: 436-43.
17. A comparison of aspirin plus tirofiban with aspirin plus heparin for unstable angina. Platelet Receptor Inhibition in Ischemic Syndrome Management (PRISM) Study Investigators. N Engl J Med 1998; 338: 1498-505.
18. Inhibition of the platelet glycoprotein IIb/IIIa receptor with tirofiban in unstable angina and non-Q-wave myocardial infarction. Platelet Receptor Inhibition in Ischemic Syndrome Management in Patients Limited by Unstable Signs and Symptoms (PRISM-PLUS) Study Investigators. N Engl J Med 1998; 338: 1488-97.
19. Montalescot G, Barragan P, Wittenberg O, Ecollan P, Elhadad S, Villain P, et al. Platelet glycoprotein IIb/IIIa inhibition with coronary stenting for acute myocardial infarction. N Engl J Med 2001;

344: 1895-903.
20. Kofflard MJ, de Jaegere PP, van Domburg R, Ruygrok P, van den BM, Serruys PW, et al. Immediate and long-term clinical outcome of coronary angioplasty in patients aged 35 years or less. Br Heart J 1995; 73: 82-6.
21. Mukherjee D, Hsu A, Moliterno DJ, Lincoff AM, Goormastic M, Topol EJ. Risk factors for premature coronary artery disease and determinants of adverse outcomes after revascularization in patients < or =40 years old. Am J Cardiol 2003; 92: 1465-7.
22. Patel MR, Chen AY, Peterson ED, Newby LK, Pollack CV Jr, Brindis RG, et al. Prevalence, predictors and outcomes of patients with non-ST-segment elevation myocardial infarction and insignificant coronary artery disease: results from the Can Rapid risk stratification of Unstable angina patients Suppress ADverse outcomes with Early implementation of the ACC/AHA Guidelines (CRUSADE) initiative. Am Heart J 2006; 152: 641-7.
23. Wang CH, Kuo LT, Hung MJ, Cherng WJ. Coronary vasospasm as a possible cause of elevated cardiac troponin I in patients with acute coronary syndrome and insignificant coronary artery disease. Am Heart J 2002; 144: 275-81.
24. Harding MB, Leithe ME, Mark DB, Nelson CL, Harrison JK, Hermiller JB, et al. Ergonovine maleate testing during cardiac catheterization: a 10-year perspective in 3,447 patients without significant coronary artery disease or Prinzmetal's variant angina. J Am Coll Cardiol 1992; 20: 107-11.
25. Diver DJ, Bier JD, Ferreira PE, Sharaf BL, McCabe C, Thompson B, et al. Clinical and arteriographic characterization of patients with unstable angina without critical coronary arterial narrowing (from the TIMI-IIIA Trial). Am J Cardiol 1994; 74: 531-7.
26. Moccetti T, Malacrida R, Pasotti E, Sessa F, Genoni M, Barlera S, et al. Epidemiologic variables and outcome of 1972 young patients with acute myocardial infarction. Data from the GISSI-2 database. Investigators of the Gruppo Italiano per lo Studio della Sopravvivenza nell'Infarto Miocardico (GISSI-2). Arch Intern Med 1997; 157: 865-9.
27. Chouhan L, Hajar HA, Pomposiello JC. Comparison of thrombolytic therapy for acute myocardial infarction in patients aged < 35 and > 55 years. Am J Cardiol 1993; 71: 157-9.
28. Weiss EJ, Bray PF, Tayback M, Schulman SP, Kickler TS, Becker LC, et al. A polymorphism of a platelet glycoprotein receptor as an inherited risk factor for coronary thrombosis. N Engl J Med 1996; 334: 1090-4.

ภาวะกล้ามเนื้อหัวใจขาดเลือดเฉียบพลันในผู้ป่วยผู้ใหญ่ที่อายุน้อย: ข้อมูลจากทะเบียนผู้ป่วยกล้ามเนื้อหัวใจขาดเลือดเฉียบพลันแห่งประเทศไทย

วิวรรณ ทังสุบุตร, ดำรัส ตรีสุโกศล, วศิน พุทธารี, วัฒนา บุญสม, โสภณ สงวนวงษ์, บุญชู ศรีชัยเวชย์

ภูมิหลัง: *ในประเทศไทยข้อมูลผู้ป่วยผู้ใหญ่ที่อายุน้อยที่เกิดภาวะกล้ามเนื้อหัวใจขาดเลือดเฉียบพลัน (ACS, acute coronary syndrome) มีจำนวนจำกัด*

วัตถุประสงค์: *การศึกษานี้มีจุดประสงค์ เพื่อประเมินผู้ป่วย ACS ที่มีอายุน้อยเปรียบเทียบกับผู้ป่วยสูงอายุ ในด้านปัจจัยเสี่ยง อาการนำ การรักษา ผลแทรกซ้อน และผลการรักษาขณะอยู่ในโรงพยาบาล*

วัสดุและวิธีการ: *จากฐานข้อมูลทะเบียนผู้ป่วยกล้ามเนื้อหัวใจขาดเลือดเฉียบพลันในประเทศไทย (Thai ACS registry) ตั้งแต่วันที่ 1 สิงหาคม พ.ศ. 2545 ถึง 31 ตุลาคม พ.ศ. 2548 มีผู้ป่วย 9,373 คนที่เข้ารับการรักษาในโรงพยาบาลที่ร่วมโครงการ Thai ACS registry การศึกษานี้ได้แยกผู้ป่วยเป็นกลุ่มอายุ 3 กลุ่ม ได้แก่ < 45 ปี, 45-54 ปี และ > 54 ปี ข้อมูลที่นำมาวิเคราะห์ได้แก่ ปัจจัยเสี่ยง อาการนำ ชนิดของ ACS การรักษา ผลแทรกซ้อน และผลการรักษาขณะอยู่ในโรงพยาบาลของทั้ง 3 กลุ่มอายุ*

ผลการศึกษา: *ผู้ป่วยอายุ < 45 ปีมี 5.8% (544 ราย) ของผู้ป่วย ACS ทั้งหมด การวินิจฉัยโรคในกลุ่มอายุ < 45 ปี เป็น ST-segment elevation myocardial infarction (STEMI) 67%, non-ST-segment elevation myocardial infarction (NSTEMI) 20% และ unstable angina 14% ปัจจัยเสี่ยงพบว่าการสูบบุหรี่และโรคหลอดเลือดหัวใจในครอบครัวพบในผู้ป่วยอายุน้อย บ่อยกว่าผู้ป่วยสูงอายุ ส่วนเบาหวานและความดันโลหิตสูงพบน้อยกว่า ที่สำคัญผู้ป่วยอายุน้อยที่สูบบุหรี่มีมากถึง 66% ผู้ป่วยอายุน้อยได้รับการฉีดสีโคโรนารี การถ่างขยายหลอดเลือดหัวใจด้วยบอลลูนได้รับยาแอสไพริน thienopyridine GPIIb/IIIa antagonist beta-blockers และ statin มากกว่า ผลการรักษาพบผู้ป่วยอายุน้อยเสียชีวิตน้อยกว่า เกิดภาวะ congestive heart failure น้อยกว่า และอยู่โรงพยาบาลระยะสั้นกว่าผู้ป่วยสูงอายุ*

สรุป: *ในประเทศไทย 5.8% ของผู้ป่วย ACS มีอายุน้อยกว่า 45 ปี พบความแตกต่างในแง่ปัจจัยเสี่ยงระหว่างผู้ป่วยอายุน้อยกับผู้ป่วยสูงอายุ การรักษาผู้ป่วยอายุน้อยอยู่ในเกณฑ์ดี และอัตราการเสียชีวิตต่ำกว่าผู้ป่วยสูงอายุ*