Original Article

Chest Pain in Young Adults; Acute Myocardial Infarction vs. Non-Coronary Chest Pain in the Emergency Setting

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Background: There has been an increasing number of young adults who presented at the emergency room (ER) with chest pain. Although it is uncommon for coronary disease to be the etiology chest pain in young adults, every patient who presents with chest pain should be considered as a potentially serious condition. Therefore, knowing the differential characteristics between young adults with chest pain due to acute myocardial infarction (AMI) and young adults with non-coronary chest pain might help differentiating between the two groups.

Objective: To study the differential characteristics between young adults who visited ER with chest pain due to AMI and the non-coronary chest pain and to determine factors that associated with AMI in young adults.

Materials and Methods: A retrospective descriptive study conducted at the emergency department, Srinagarind Hospital, Khon Kaen, Thailand. Clinical data of patients aged 15 to 44 years old who presented with chest pain and were admitted to the hospital were collected. The patients were classified into two groups 1) AMI group and 2) Non-coronary chest pain group. The clinical characteristics between the two groups were compared. Clinical risk factors of AMI were studied.

Results: There were 52 and 76 patients in the AMI and the non-coronary chest pain group. Patients in the AMI group were older, 39.6±4.0 vs. 30.3±9.7 years old (p<0.001), had higher body mass index (BMI), higher diabetes mellitus (DM), dyslipidemia, and smoking (all p<0.001). The AMI group had higher blood sugar, and cholesterol (167.8±99.2 mg/dl vs. 119.1±55.0 mg/dl, p = 0.012 and 204.9±90.2 mg/dl vs. 171.0±72.0 mg/dl, p = 0.035). Dyslipidemia, smoking, and age 35 to 44 years old were independently associated with AMI (OR 54.8, 95% CI 9.9 to 303.1, OR 22.2, 95% CI 3.0 to 162.5, and OR 17.3, 95% CI 2.3 to 128.6, respectively).

Conclusion: Young adults with AMI tended to have metabolic risk factors such as DM, dyslipidemia, and smoking. Furthermore, the conventional metabolic risk factors such as dyslipidemia, smoking, and increasing age were found to be independent risk factors of AMI in the young adults.

Keywords: Acute coronary syndrome, Young patients, Emergency, Angina, Thai

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Chest pain is one of the most common chief complaints in the emergency room (ER)[1]. It is a diagnostic challenge since the symptoms of chest pain may be caused by a life threatening condition namely acute myocardial infarction (AMI) or such diverse milder diseases of other organ systems[2].

There has been an increasing number of young adults who presented at the ER with chest pain[3]. Although most of them were found to have a non-cardiac cause for the symptoms i.e. gastroesophageal reflux disease (GERD)[4], costochondritis, or pneumonia[5], every patient who presents with chest pain should be considered as a potentially serious condition. History taking about the time of onset, duration of symptoms, the intensity of pain, and clinical risk factors should be done thoroughly as well as physical examinations and laboratory testing[6]. However, there were evidences that providers were likely to dismiss chest pain in younger patients because of the rare occurrence of significant morbidity and mortality[7]. To know the differential characteristics between young adults with chest pain due to AMI and young adults with non-coronary chest pain might help differentiating between the two groups.

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Objective

The authors aimed to study the differential characteristics between young adults who visited ER with chest pain due to AMI and the non-coronary chest pain. Secondly, we aimed to determine the factors that associated with AMI in young adults.

Materials and Methods

Study design and setting

This was a retrospective descriptive study, taken place at the emergency outpatient department of Srinagarind

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Hospital, a tertiary-level university hospital, Khon Kaen, Thailand.

The authors retrospectively collected clinical data of consecutive patients aged 15 to 44 years old who presented with chest pain and were admitted to the hospital by searching the hospital's database during year 2005 to 2009. Then, the definite diagnosis was classified by using International Classification of Disease-10 (ICD-10). For the group of AMI, ICD-10 I21 was used for searching and for the group of non-coronary chest pain. We focused mainly on 4 most common diagnosis: 1) Costochondritis, 2) GERD, 3) Pneumonia, and 4) other pericardial disease (ICD-10 I31, M948, K21, and J15). The exclusion criteria were: 1) Patients who were referred to another hospitals, 2) Incomplete data, 3) Non-Asian population. This study was approved by the ethical committee in human research, Khon Kaen University (HE531345).

Sample size calculation

The authors acquired a sample for a study of young adult patients who came to the ER with chest pain. The main objective was to compare clinical characters of the group with AMI with a non-coronary chest pain group. A confidence level of 0.05 and ±3% margin of error were used, the minimum sample size was 130. The authors enrolled patients with AMI and did cluster sampling for patients with non-coronary chest pain. After evaluating for the exclusion criteria, there were 52 and 76 patients in the AMI group and the non-coronary chest pain group, respectively (Figure 1).

Statistical analysis

The authors used means and standard deviations (SD) to describe continuous variables. Counts and percentages were used for categorical variables. An independent sample t-test and a Chi-square test were used to compare between groups for continuous variables and categorical variables, respectively. Univariate analysis and multivariate analysis were used to identify factors associated with AMI. The authors reported odd ratios (ORs), adjusted odds ratios (adjusted ORs), 95% confidence interval (95% CI), and *p*-values. A *p* of less than 0.05 was described as statistically significant. All statistical analyses were performed with SPSS for Mac version 20.0, registered to Khon Kaen University.

Results

Comparison of baseline characteristics between the AMI group and non-coronary chest pain group

There were 52 and 76 patients in the AMI and the non-coronary chest pain group respectively. Patients in the AMI group were significantly older, 39.6±4.0 and 30.3±9.7 years old, respectively ($p<0.001$). The AMI group also had higher body mass index (BMI), higher rate of diabetes mellitus (DM), and dyslipidemia, all $p<0.001$. There were 48.1% of the AMI group who were current smokers vs. only 5.3% in the non-coronary chest pain group ($p<0.001$). There were also higher alcohol drinking patients in the AMI group (23.1%) compared with 2.6% in the non-coronary chest pain group ($p<0.001$). More than 5% of patients in the AMI group had a family history of premature coronary artery disease while there was none in the non-coronary chest pain group (Table 1).

Regarding the clinical characters, the AMI group had significantly lower oxygen saturation compared with the non-coronary chest pain group, 91±20% vs. 95±4%, $p<0.001$.

Average pulse rate of the AMI group was also lower than the non-coronary chest pain group, 85±30 beats per minute (bpm) vs. 104±22 bpm, $p<0.001$. However, the

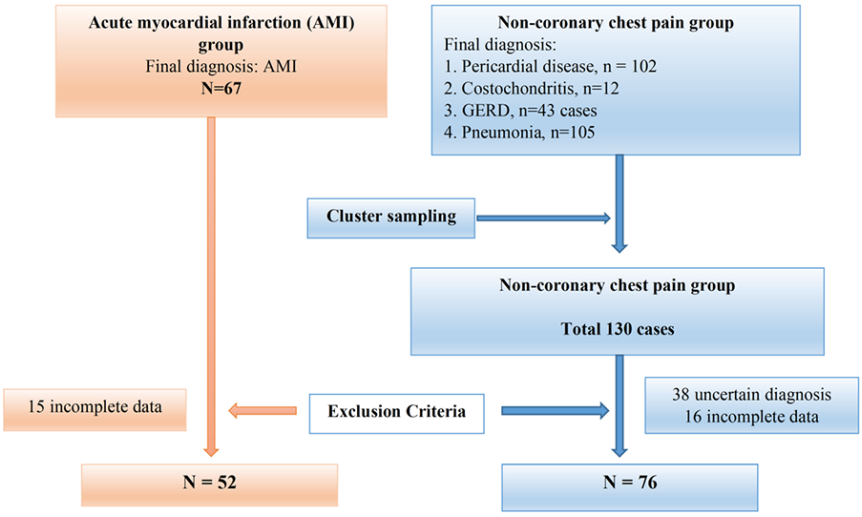

Figure 1. Flow of study patients.

Table 1. Comparison of baseline characteristics between the AMI group and non-coronary chest pain group

Characteristics	AMI (n = 52)	Non-coronary chest pain (n = 76)	*p*-value
Age, year (mean ± SD)	39.6±3.9	30.3±9.7	<0.001
Sex (men: women ratio)	43:9 (4.8:1)	39:37 (1.1:1)	0.003
Body weight (kg)	67.4±11.1	51.4±10.9	<0.001
BMI (kg/m^2) (mean ± SD)	24.8±3.9	20.4±4.2	<0.001
Underlying diseases, n (%)			
Diabetes mellitus	14 (20.9)	4 (5.3)	0.001
Hypertension	12 (20.1)	8 (10.5)	0.055
Dyslipidemia	43 (52.7)	6 (7.9)	<0.001
1st diagnosis dyslipidemia	33 (63.5)	4 (5.3)	<0.001
Obesity, n (%)	15 (28.8)	3 (3.9)	0.0001
Current smoker, n (%)	25 (48.1)	4 (5.3)	<0.001
Alcohol drinking, n (%)	12 (23.1)	2 (2.6)	0.001
Family history of premature coronary disease, n (%)	3 (5.8)	0 (0)	0.034
Vital signs			
Body temperature (°C)	37.1±0.7	37.4±1.5	0.059
Pulse rate (/min)	85±30	104±22	<0.001
Respiratory rate (/min)	24±12	26±1	0.288
Systolic BP (mmHg)	118±35	122±28	0.480
Diastolic BP (mmHg)	74±24	75±19	0.918
O_2 saturation (%)	91±20	95±4	<0.001
Pain characteristics			
Typical chest pain, n (%)	49 (94)	0 (0)	<0.001
Onset (hours)	82.53±322.99	510.50±984.39	0.261

Table 2. Comparison of laboratory results between the AMI group and non-coronary chest pain group

	AMI group (n = 52)	Non coronary chest pain group (n = 76)	*p*-value
CKMB	152.29±265.50	32.43±34.37	0.242
TnT	5.47±11.50	1.02±1.41	0.594
Hct	39.9±6.9	32.1±7.6	<0.001
Blood sugar	167.8±99.4	119.1±55.0	0.012
BUN	20.3±21.3	21.9±20.5	0.679
Cr	1.70±2.37	1.62±3.05	0.880
Sodium	136.9±4.8	134.7±5.0	0.019
Cholesterol	204.9±90.2	171.0±72.0	0.035
Triglyceride	192.7±139.3	300.8±208.7	0.126
HDL-C	41.6±12.9	43.2±10.8	0.785
LDL-C	134.3±91.8	173.8±71.0	0.358

CKMB = Creatine kinase-MB, TnT = Troponin T, Hct = hematocrit, BUN = blood urea nitrogen, Cr = creatinine, HDL-C = high density cholesterol, LDL-C = low density cholesterol

body temperature, respiratory rate, and blood pressure were not statistically significant (Table 1).

For the laboratory results, a single measurement of cardiac biomarker level (CKMB and Troponin-T (TnT)) was not significantly difference between the two groups. The AMI group had higher hematocrit level, 39.9±6.7% vs. 32.1±7.6% of the non-coronary chest pain group, p<0.001. Regarding the metabolic disease parameters, the AMI group had higher blood sugar, and cholesterol compared with the non-coronary chest pain group, 167.8±99.2 mg/dl vs. 119.1±55.0 mg/dl, p = 0.012 and 204.9±90.2 mg/dl vs. 171.0±72.0 mg/dl, p = 0.035, respectively (Table 2).

Factors associated with AMI in young adults

From the univariate analysis, we found that dyslipidemia (OR 55.7, 95% CI 18.5 to 167.6, p<0.001), obesity (OR 9.9, 95% CI 2.7 to 36.2, p<0.001), current smoking (OR 16.7, 95% CI 5.3 to 52.3, p<0.001), alcohol drinking (OR 11.1, 95% CI 2.4 to 52.1, p<0.001), men (OR 4.5, 95% CI 1.9 to 10.6, p<0.001), and age 35 to 44 years old

Table 3. Factors associated with AMI in young adults

Risk factors	Crude OR (95% CI)	*p*-value	Adjusted OR (95% CI)	*p*-value
Diabetes mellitus	6.6 (2.0 to 21.6)	0.001	4.6 (0.5 to 39.6)	0.217
Hypertension	2.6 (1.0 to 6.8)	0.055	NA	NA
Dyslipidemia	55.7 (18.5 to 167.6)	<0.001	54.8 (9.9 to 303.1)	<0.001
Obesity	9.9 (2.7 to 36.2)	<0.001	15.3 (0.8 to 309.1)	0.075
Current smoking	16.7 (5.3 to 52.3)	<0.001	22.2 (3.0 to 162.5)	0.002
Alcohol drinking	11.1 (2.4 to 52.1)	<0.001	0.6 (0.1 to 7.5)	0.679
Men	4.5 (1.9 to 10.6)	<0.001	1.9 (0.3 to 11.1)	0.472
Age 35 to 44 years	11.1 (4.3 to 29.2)	<0.001	17.3 (2.3 to 128.6)	0.005

(OR 11.1, 95% CI 4.3 to 29.2, $p<0.001$) were significantly associated with AMI. However, when multivariate analysis was performed, only dyslipidemia, current smoking, and age 35 to 44 years old were independent factors that associated with AMI (OR 54.8, 95% CI 9.9 to 303.1, $p<0.001$, OR 22.2, 95% CI 3.0 to 162.5, $p = 0.002$, and OR 17.3, 95% CI 2.3 to 128.6, $p = 0.005$, respectively) (Table 3).

Discussion

The present study sought to find the differential characteristics of adults aged below 45 years who presented in the ER with chest pain due to AMI vs. those with non-coronary chest pain. The authors found that conventional metabolic risk factors such as older age, higher BMI, DM, dyslipidemia, and smoking were more common in the AMI group. Furthermore, blood sugar and cholesterol were also higher in the AMI group. Factors that independently associated with AMI in young adults in the present study were dyslipidemia, smoking, and aged 35 to 44 years old.

Many studies in general population and older adults addressed that the conventional metabolic risk factors e.g. high blood sugar, DM, dyslipidemia, overweight/obesity, and smoking were important determinants of AMI[8,9]. Our findings emphasized the importance of these modifiable risk factors in the young adults which were correlated well with a prior study in adults aged 18 to 44 years old by Yandapalli et al which found that risk factors including smoking, dyslipidemia, and hypertension were most prevalent in young adults with first AMI[10]. A study by Honk MK et al from Korea also compared the young adults aged below 40 years old who had coronary artery disease (CAD) with those who had not and found that the differential characteristics were age and DM. Their results were in line with ours, the group with CAD were older (37.5 years old vs. 32.9 years old), and had higher rate of DM. But dyslipidemia and smoking was not found to cause any difference between both groups in their study[11]. However, they did not perform univariate and multivariate analysis to identify the factors that significantly associated with CAD because there was no control group. Another study from Bangladesh also described the characteristics of young adults who were diagnosed AMI. They enrolled a younger age group than ours (age <35 years old). Even at a younger age, their AMI patients also presented with conventional metabolic risk factors including smoking (77.4%) and dyslipidemia (70.3%)[12]. However, the study also did not have a control group of non-AMI patients; therefore, they did not report the risk factors that associated with AMI in young adults.

The strength of our study was that we had both AMI group and non-coronary chest pain group for comparison. Among the non-coronary chest pain group, the diagnosis was clear (GERD, costochondritis, pneumonia, and other pericardial diseases). Therefore, it is useful for generalization purposes and in applying our results for real time practice in the ER. However, there were potential limitations. First, this was a single center study in a 1,000-bed tertiary care hospital; therefore, the patient's characteristics may be different from the other level hospitals. Second, according to the retrospective nature, there were some missing data that might affect the subject numbers. Therefore, care should be taken when extrapolating the results.

Conclusion

Young adults with AMI tended to have metabolic risk factors such as DM, dyslipidemia, and smoking. Furthermore, similar to the older adults, the conventional metabolic risk factors such as smoking, dyslipidemia, and increasing age were found to be independent risk factors of AMI in the young adults. Therefore, to decrease the risk of AMI in the young population, these metabolic risk factors should be modified.

What is already known on this topic?

Chest pain is one of the most common chief complaints in the ER. Recently, the numbers of young adults who presented to the ER with chest pain has been rising. Although the major cause of chest pain in young adults was not AMI, it is crucial for emergency physician to differentiate AMI from non-coronary artery chest pain.

What this study adds?

Young adults with AMI tended to have higher metabolic risk factors such as DM, dyslipidemia, and smoking. Therefore, when confronting young-adult patients

who present with chest pain, besides history taking and physical examination, the laboratory testing to identify metabolic derangement might help in increasing the awareness of the presenting of AMI.

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Potential conflicts of interest

The authors declare no conflict of interest.

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อาการเจ็บหน้าอกในผู้ใหญ่ตอนต้น: ภาวะหัวใจขาดเลือดเฉียบพลันและอาการเจ็บหน้าอกที่ไม่เกี่ยวข้องกับโรคหลอดเลือดหัวใจในภาวะฉุกเฉิน

ฐปนวงศ์ มิตรสูงเนิน, แพรว โคตรุนิน

ภูมิหลัง: ปัจจุบันพบว่าผู้ป่วยวัยผู้ใหญ่ตอนต้นที่มาห้องฉุกเฉินด้วยอาการเจ็บหน้าอกมีจำนวนมากขึ้น แม้ว่าสาเหตุที่พบส่วนใหญ่จะไม่ใช่โรคหลอดเลือดหัวใจแต่ผู้ป่วยทุกคนที่มาห้องฉุกเฉินด้วยอาการเจ็บหน้าอกจัดว่าเป็นภาวะที่รุนแรง ดังนั้นหากเราทราบลักษณะทางคลินิกที่แตกต่างกันระหว่างผู้ป่วยที่มีอาการเจ็บหน้าอกจากภาวะหัวใจขาดเลือดเฉียบพลันกับผู้ที่มีอาการเจ็บหน้าอกที่ไม่เกี่ยวข้องกับโรคหลอดเลือดหัวใจอาจจะช่วยในการวินิจฉัยแยกโรคได้

วัตถุประสงค์: เพื่อศึกษาลักษณะทางคลินิกที่แตกต่างกันระหว่างผู้ใหญ่ตอนต้นที่มาด้วยอาการเจ็บหน้าอกจากภาวะหัวใจขาดเลือดเฉียบพลันกับอาการเจ็บหน้าอกที่ไม่เกี่ยวข้องกับโรคหลอดเลือดหัวใจและเพื่อศึกษาหาปัจจัยที่ส่งผลต่อการเกิดภาวะหัวใจขาดเลือดเฉียบพลันในผู้ใหญ่ตอนต้น

วัสดุและวิธีการ: การศึกษาย้อนหลังซึ่งทำที่แผนกอุบัติเหตุฉุกเฉิน โรงพยาบาลศรีนครินทร์ จังหวัดขอนแก่น ประเทศไทย ข้อมูลทางคลินิกของผู้ป่วยอายุ 15 ถึง 44 ปี ซึ่งมาโรงพยาบาลด้วยอาการเจ็บหน้าอกได้ถูกรวบรวม ผู้ป่วยถูกแบ่งเป็นสองกลุ่มคือกลุ่มที่ถูกวินิจฉัยว่ามีภาวะหัวใจขาดเลือดเฉียบพลันกับกลุ่มที่มีอาการเจ็บหน้าอกที่ไม่เกี่ยวข้องกับโรคหลอดเลือดหัวใจเพื่อเปรียบเทียบลักษณะทางคลินิกระหว่างสองกลุ่มและหาปัจจัยเสี่ยงของภาวะหัวใจขาดเลือดเฉียบพลัน

ผลการศึกษา: มีผู้ป่วยจำนวน 52 คนในกลุ่มหัวใจขาดเลือดเฉียบพลันและ 76 คนในกลุ่มที่ไม่เป็นโรคหลอดเลือดหัวใจ กลุ่มหัวใจขาดเลือดเฉียบพลันมีอายุมากกว่า (39.6±4.0 ปี เทียบกับ 30.3±9.7 ปี) มีโรคเบาหวาน ไขมันในเลือดสูงและสูบบุหรี่มากกว่าอย่างมีนัยสำคัญทางสถิติ กลุ่มที่มีภาวะหัวใจขาดเลือดเฉียบพลันมีน้ำตาลในเลือดและคอเลสเตอรอลสูงกว่า (167.8±99.2 มก./ดล. เทียบกับ 119.1±55.0 มก./ดล., $p = 0.012$ และ 204.9±90.2 มก./ดล. เทียบกับ 171.0±72.0 มก./ดล., $p = 0.035$) ปัจจัยที่เกี่ยวข้องกับภาวะหัวใจขาดเลือดเฉียบพลันในผู้ใหญ่ตอนต้น ได้แก่ ไขมันในเลือดสูง สูบบุหรี่ และอายุตั้งแต่ 34 ถึง 44 ปี (OR 54.8, 95% CI 9.9 ถึง 303.1, OR 22.2, 95% CI 3.0 ถึง 162.5, และ OR 17.3, 95% CI 2.3 ถึง 128.6, ตามลำดับ)

สรุป: ผู้ใหญ่ตอนต้นที่มีอาการเจ็บหน้าอกจากภาวะหัวใจขาดเลือดเฉียบพลันมีแนวโน้มที่จะพบภาวะเมตาบอลิกผิดปกติ ได้แก่ เบาหวาน ไขมันในเลือดสูงและสูบบุหรี่มากกว่าคนที่มาโรงพยาบาลด้วยอาการเจ็บหน้าอกที่ไม่เกี่ยวข้องกับโรคหลอดเลือดหัวใจ และพบว่าปัจจัยเสี่ยงของภาวะหัวใจขาดเลือดเฉียบพลันในผู้ใหญ่ตอนต้นคือ ไขมันในเลือดสูง สูบบุหรี่ และอายุที่เพิ่มขึ้น