Clinical Profile of Acute Myocardial Infarction at King Abdulaziz University Hospital, Jeddah, Saudi Arabia

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ABSTRACT

Objectives: This study aimed to assess the clinical profile of myocardial infarction in a tertiary care hospital in Saudi Arabia, and to determine the differences in presentation, risk factors, complications, and mortality between old and young patients.

Methods: Retrospective analysis of demographic and clinical data of adult myocardial infarction patients treated in King Abdulaziz University Hospital between 2010 and 2018.

Results: A total of 543 acute myocardial infarction patients (79.4% males) were included in the analysis. There were 64 patients aged ≤ 45 years and 479 patients aged > 45 years. The most common presenting symptom was chest pain in both groups. Current smoking was the most common risk factor in the younger group, whereas diabetes mellitus and hypertension were the most common risk factors in the older group. On electrocardiography, ST-elevation myocardial infarction was more common in the younger group. Mitral regurgitation, followed by congestive heart failure, were the most common complications in both groups. The overall mortality rate was low, but it was higher in the older group.

Conclusion: Risk factors and electrocardiogram findings differ significantly between younger (≤ 45 years) and older (> 45 years) patients. Smoking cessation must be stressed in young adults. Population awareness regarding the modifiable risk factors of myocardial infarction could help in decreasing its incidence.

Keywords
Myocardial infarction; Smoking; Diabetes; Hypertension

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INTRODUCTION

According to the World Health Organization, cardiovascular disease (CVD) affects nearly one-third of the world's population\(^1\), and is associated with a high mortality rate (46% in 2014)\(^2\). Myocardial infarction (MI), which is one of the dangerous forms of CVD, most commonly results from coronary artery disease (CAD). According to one estimate, a new case of MI occurs once every 40 seconds worldwide\(^3\). Coronary artery disease, which accounts for a substantial proportion of all MI deaths\(^4\), has a prevalence of 5.5% in Saudi Arabia\(^5\).

Risk factors for the development of MI include hypertension, DM, dyslipidemia, smoking, and abdominal obesity. In patients with multiple risk factors, modification of even one can improve outcomes\(^6\). Urbanization is partly responsible for the high prevalence of modifiable CAD risk factors\(^6\). Coronary artery disease, rarely seen in individuals under 30 years of age before 1950\(^7\), is becoming increasingly diagnosed among younger patients\(^8\). In these young patients, family history is an important risk factor for the development of MI. A study by the University of Michigan Medical Center shows that family history of CAD is more likely in young MI patients than in older patients\(^9\).

In previous studies, family history, smoking, and hypercholesterolemia were the most common risk factors in patients ≤ 45 years old, while hypertension and diabetes were the common risk factors in patients > 45 years\(^10,11\). One recent study found smoking and dyslipidemia to be the commonest risk factors in both age-groups\(^12\). Many studies have shown that mortality due to MI is higher in older patients\(^13-18\); however, a recent study found comparable mortality in the young and the old, but relatively lower morbidity in the former\(^12\).

This study was conducted to assess the profile of MI in a tertiary care hospital in Saudi Arabia, and to determine how risk factors, mode of presentation, outcome, and mortality vary between younger and older patients.

METHODS

This study performed a retrospective review of adult patients diagnosed with MI at King Abdulaziz University Hospital (KAUH), Jeddah, Saudi Arabia, during 2010-2018. A total of 583 patients were diagnosed with MI during this period. However, 40 patients were excluded because of missing data. The patients were separated into two groups according to age: patients aged ≤ 45 years and patients aged > 45 years. Most previous studies have used this cutoff to define “young” patients\(^9-10,19-26\). Demographic characteristics, risk factors (diabetes, hypertension, dyslipidemia, family history of CAD, smoking, and obesity), clinical profile, and outcomes were obtained from the cases records and compared between the two groups. The diagnosis of acute MI was based on 12-lead electrocardiogram findings. The cases were classified as non-ST segment elevation MI (NSTEMI) or ST segment elevation MI (STEMI) according to the 2004 American College of Cardiology/American Heart Association (ACA/AHA) guidelines. The diagnosis of post-MI complications such as mitral regurgitation and congestive failure were based on echocardiography.

This study was approved by Institutional Review Board of KAUH.

STATISTICAL ANALYSIS

Statistical analysis was carried out using IBM SPSS Statistics for Windows, Version 20 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as the means (± Standard deviation) and compared using the unpaired t-test. Categorical variables were summarized as percentages and compared using the chi-squared test or Fisher’s exact test. P ≤ 0.05 was considered statistically significant.

RESULTS

Of the 583 patients treated for acute MI during the study period, 543 patients (79.4% men and 21.6% women) met the inclusion criteria: they included 64 patients aged ≤ 45 years and 479 patients aged > 45 years. The mean age was 59.2 ± 12.0 years (age range, 26-92 years). Table 1 summarizes the demographic characteristics of the study population.

Symptoms

Chest pain was the most common symptom, with 85.2% of patients having it at presentation; it was more likely in the younger patients than in the older patients (91% vs. 84.4%). The next most common symptom was shortness of breath, which was more common in the older group (25.2% vs. 19%). Dizziness, epigastric pain, and altered consciousness were also more frequent in the older group (Fig. 1 and 2).

TABLE 1.

Demographic characteristics of patients in the two groups

<table>
<thead>
<tr>
<th></th>
<th>Age ≤ 45 years, n (%)</th>
<th>Age &gt; 45 years, n (%)</th>
<th>Total N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>54 (84.4)</td>
<td>377 (78.7)</td>
<td>431(79.4)</td>
</tr>
<tr>
<td>Female</td>
<td>10 (15.6)</td>
<td>102 (21.3)</td>
<td>112(21.6)</td>
</tr>
<tr>
<td>Mean age, years</td>
<td>40.27 ± 4.61</td>
<td>61.92 ± 10.13</td>
<td>59.18 ± 12.01</td>
</tr>
<tr>
<td>Saudi</td>
<td>20 (31.2)</td>
<td>120 (25.1)</td>
<td>143 (26.4)</td>
</tr>
<tr>
<td>Non-Saudi</td>
<td>44 (68.8)</td>
<td>359 (74.9)</td>
<td>399 (73.6)</td>
</tr>
</tbody>
</table>
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Electrocardiogram
On electrocardiography, NSTEMI was the most common pattern overall; it was seen in 57.7% of patients. ST segment elevation MI was significantly more common in the younger group than in the older group (60.9% vs. 39.4%; \( P < 0.05 \)). Anterior wall MI was the most common type (213 cases, 51.8%).

Risk factors
Family history of CAD was significantly more common in younger patients than in older patients (21.7% vs. 9.5%; \( P < 0.05 \)). Smoking was also significantly more common in younger patients (56.5% vs. 25.8%; \( P < 0.05 \)). Diabetes, hypertension, and history of CVD were more common in the older patients (Table 2).

Complications
Mitral regurgitation was the most common complication (313 cases (59.1%), followed by congestive heart failure (106 cases, 19.6%). There was no significant difference between the two groups in the occurrence of complications. Mortality was significantly higher in older patients than in younger patients (18% vs. 5.8%; \( P < 0.05 \)) (Fig. 3).

**DISCUSSION**
Acute MI has a wide variety of clinical presentations. Generally, symptoms tend to be more prominent in younger patients and less specific in older patients. This study separated the patients into two age-groups, with 45 years as the cutoff. KAUH is a tertiary care teaching hospital, this sample included Saudis and non-Saudis. The male:female ratio was 3.76:1, which is similar to the 4.5:1 ratio in a study done in a tertiary care center.

**TABLE 2.**
Distribution of risk factors in the two groups

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Age ≤ 45 years, n (%)</th>
<th>Age &gt; 45 years, n (%)</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes mellitus</td>
<td>388 (71.7)</td>
<td>335 (75.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hypertension</td>
<td>346 (63.8)</td>
<td>322 (68.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Tobacco smoking</td>
<td>161 (29.7)</td>
<td>122 (25.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Family history of CAD</td>
<td>60 (11.1)</td>
<td>45 (9.5)</td>
<td>0.002</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>178 (32.8)</td>
<td>148 (31.3)</td>
<td>0.044</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>237 (43.7)</td>
<td>214 (45.2)</td>
<td>0.062</td>
</tr>
<tr>
<td>Overweight</td>
<td>309 (69.1)</td>
<td>271 (70)</td>
<td>.296</td>
</tr>
</tbody>
</table>

CAD: Coronary artery disease

**FIGURE 1.**
Presenting symptoms in patients aged ≤ 45 years.

**FIGURE 2.**
Presenting symptoms in patients aged > 45 years.

**FIGURE 3.**
The figure showed complication comparison between two age groups below 45 years and above 45 years. Congestive heart failure was more common in older than the 45-year-old group, reached 20%.
in India\cite{27}. In this sample the male: female ratio was lower in the older group than in the younger group (3.69:1 vs. 5.4:1), demonstrating the disappearance of the protective effect of estrogen in the elderly\cite{38}.

The most common presenting symptom was chest pain, followed by shortness of breath. This finding is consistent with another study done in 2018, which also reported chest pain (86.36%) and shortness of breath (42.42%) to be the two most common symptoms in MI patients\cite{29}. Seetharama et al.\cite{27} reported sweating with chest pain to be the most common symptom in their sample; the other common symptoms in their study were breathlessness, giddiness, palpitations, and vomiting. However, in another study from India, the most common presentation in older patients was shortness of breath (40.18%); the authors suggested that the elderly probably have reduced pain perception\cite{30-31}.

On electrocardiography, overall, NSTEMI (57.7%) was more common than STEMI (42.3%) in these patients. However, STEMI was more common in younger patients (60.9%) and NSTEMI was more common in older patients (60.6%); the difference between the groups was statistically significant (P = 0.006). Chen et al.\cite{32} reported similar findings. These results suggest a difference in the pathophysiology of MI between different age-groups\cite{32}. The most common anatomical location for the MI in young patients is reported to be the inferior wall\cite{21}; this is consistent with this study (47.7%) with P = 0.43.

A previous study of the clinical profile of MI patients at KFHU showed that the most important risk factor for MI was tobacco use followed by low high-density lipoprotein, high low-density lipoprotein, high serum triglycerides, DM, hypertension, and family history of ischemic heart disease\cite{49}. In the present study, consistent with previous research\cite{48-50}, the prevalence of diabetes (75.1% vs. 47.8%; P < 0.001) and hypertension (68.1% vs. 34.8%; P < 0.001) were significantly higher in older patients. This finding is compatible with the theory that aging is a nonmodifiable risk factor. It also reveals the long-term role of these endocrine and metabolic disorders in the development of atherosclerosis and acute coronary syndrome (ACS).

Smoking is a known risk factor for MI. It increases fibrinogen concentration, enhances platelet aggregation, impairs fibrinolytic activity, decreases coronary flow, and increases vasospasm\cite{30,38-41}. Smoking was the main risk factor in young MI patients in this sample. In previous studies the prevalence of smoking in MI patients has also ranged from 70% to 90\%\cite{17,42-43}. In this study, smoking prevalence was 56.5% in the younger group vs. 25.8% in the older group (P < 0.001). This shows the importance of the need to encourage young individuals to quit cigarette smoking. The lower prevalence of smoking in older patients was probably because there is a tendency for many individuals to quit smoking with age\cite{49}, especially when they develop multiple chronic diseases and begin to pay more attention to their health.

Family history of CAD is defined as any clinical atherosclerosis diagnosed in female relatives before 65 years and in male relatives before 55 years of age\cite{44}. In this study, family history of CAD was significantly more common in younger patients than in older patients (21.7% vs. 9.5%; P = 0.002). A previous study that specifically examined this risk factor reported similar results\cite{45}.

Myocardial infarction may result in serious complications such as severe mitral regurgitation, cardiac rupture\cite{46}, heart failure, cardiogenic shock, ventricular tachycardia, ventricular fibrillation, supraventricular tachycardia, and so on\cite{47}. In the present study, the most common complication was mitral regurgitation (59%), this is a very high percentage compared to other studies. It may be because this study included all grades of mitral regurgitation (mild, moderate, and severe), whereas some studies only considered moderate and severe grades\cite{48,49}. According to the Saudi Heart Association, approximately 30%-50% of patients with MI will develop ischemic mitral regurgitation. In previous reports the incidence of post-MI mitral regurgitation has ranged from 11% to 59%; the wide variation probably being due to the diagnostic modality used. Earlier studies mostly depended on clinical and angiographic parameters; however, with the introduction of new modalities (such as Doppler echocardiography), more and more cases of post-MI MR are being detected. At KAУH all patients were diagnosed by Doppler echocardiography.

The second most common complication was congestive heart failure; the incidence was 11.6% in the older age-group and 20.8% in the younger age-group. In the Saudi Project for Assessment of Coronary Events (SPACE) registry, the overall incidence of in-hospital congestive cardiac failure following ACS was 10.2% (519/5055 patients). The relatively lower incidence was probably because this registry included all types of ACS, whereas this study enrolled only patients who had suffered acute MI. Studies from other countries have reported a higher incidence of congestive heart failure in MI patients\cite{50,50}. The lower incidence in these patients may have been because this study population comprised patients attending a tertiary care center. These patients were likely receiving regular medical care from this center, which is one of the best in Saudi Arabia. The incidence of congestive cardiac failure after MI may be higher in the rural areas where access to the latest medical technology is limited.

Reinfarction was the third most common complication in this sample; the incidence was 16.5% in the older group and 17.4% in the younger group. Previous studies have also reported a high frequency of reinfarction\cite{41}. Other important complications of MI in this study were cardiogenic shock (10.2%) and post MI angina (12.8%).
A previous study from Saudi Arabia showed much lower rates for both (4.6% and 3.1%, respectively)[19].

Mortality was significantly higher in the older patients than in younger patients in this sample (18% vs. 5.8%; \( P = 0.011 \)). This result is consistent with a previous study in which the mortality rates were 28.04% and 8.6%, respectively[25].

According to Rattan[52] aging starts at 40-50 years. The adaptations of cardiovascular system to stress is impaired as the aging process causes changes in the anatomy, function, and metabolism of the heart. Furthermore, arterial bed changes and poor vasodilatory capacity of the peripheral vessels impairs ventricular ejection. Age-related impairment of ventricular function and of the adaptive mechanisms to the hemodynamic burden due to myocardial necrosis explain why ventricular dysfunction occurs more frequently in older patients before and during an acute MI[53]. Comorbidities, which are more common in the aged, also contribute to the higher morbidity and mortality.

CONCLUSION

Myocardial infarction patients presenting at the KAUH were mostly males and aged >45 years.

Chest pain was the most common presenting symptom in both the younger and older age-groups. While diabetes and hypertension were the most common risk factors among older patients, smoking was the most common risk factor among the younger patients. The latter were also more likely to be overweight or have dyslipidemia and family history of CAD.

Mild mitral regurgitation, followed by congestive heart failure, were the most common complications. Mortality was higher in the older age-group.

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Conflict of Interest

The authors have no conflict of interest.

Disclosure

The authors have not receive any type of commercial support either in the form of compensation or other finances for this study. The authors have no financial interest in any of the products devices, or drugs mentioned in this article.

Ethical Consent

Informed consent was obtained from each participant after approval of The Unit of Biomedical Ethics Research Committee at King Abdulaziz University.

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لمحة سريرية عن احصاء عضلة القلب الحاد في مستشفى جامعة الملك عبد العزيز

المملكة العربية السعودية

مراعي عبد الحميد جبلي، رنا عبد الله نيلاوي، ابتهال عمر الصهوني، مرام ظهير المطيري، فاطمة ابراهيم

الصفات، جاني محمد جناف، رفعت عبد الله القرني

قسم الباطنة، كلية الطب، جامعة الملك عبد العزيز

جدة - المملكة العربية السعودية

المستخلصات

تهدف هذه الدراسة إلى تقييم الملفات الطبية لمرضى احصاء عضلة القلب ومعرفة الفرق بين صغار السن وكباره من حيث

الأعراض، عوامل الخطورة المضاعفات ومعدلات الوفاة

الأسباب: تم إجراء دراسة رجعية النطاق من خلال فحص سجلات المرضى (18 عام) الذين لديهم احصاء في عضلة القلب

في مستشفى الملك عبد العزيز الجامعي، جدة، المملكة العربية السعودية بين 2010-2018 م.

النتائج: تم إجراء 543 شخص تم تشخيصهم باحصاء عضلي حاد (74.9%) كان من ذكور تم تقسيم المرضى إلى فئتين فئة

صغير السن <= 65 عام والتي تمثل 64 مريض وفئة الكبر > 65 عام تمثل 49 مريض، كان العرض الأكثر شيوعا هو ألم

الصدر لل רבين. ووجدنا ان الربين هو الأكثر خطورة بين الشباب في حين كان داء السكري وارتفاع ضغط الدم أكثر في كبار

السن.

الخاتمة: دراستنا اكدت وجود فرق بين المجموعات من حيث عوامل الخطر ونتائج تخطيط القلب. يجب التركيز على عامل الخطورة

الربين لدى صغار السن. إذا تحتاج إلى اكتشاف عوامل الخطورة مبكرًا لمنع حدوث هذا المرض، وزيادة التوعية حولها وأهمية الحرص

على نمط حياة صحي