Multicenter observational study of risk factors profile in a sample of Egyptian Patients with Acute Coronary Syndrome (part of Egyptian Cardiovascular Risk Factors Project)

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Abstract: Objective The aim of the study was to assess the pattern of risk factors of acute coronary syndrome (ACS) in different age groups and sex categories. **Background** ACS refers to a spectrum of clinical presentations ranging from those for ST◀segment elevation myocardial infarction to presentations found in non◀ST□segment elevation myocardial infarction or in unstable angina and our study focus on ST□segment elevation myocardial infarction and non□ST□segment elevation myocardial infarction. **Patients and methods:** This is a prospective, observational, noncontrolled study including 100 patients with ACS who were admitted at Mahalla Cardiac Center from MAY 2016 to JULY 2018. The patients were classified into four groups according to age: patients younger than 45 years, patients between 45 and 55 years, patients between 55 and 64 years, and patients aged 65 years or older. Further, a comparison was made between male and female patients. **Results**: There was a significant difference between the studied groups as regards the prevalence of diabetes mellitus (DM), hypertension (HTN), and cigarette smoking and positive family history of premature CAD, with no significant difference as regards previous cardiac events. Regarding to hypertension. Our study showed increased levels of TGs, BMI, waist circumference, increased total cholesterol, LDL and decreased HDL was higher in hypertensive than non-hypertensive with statistically significant difference between both groups. Regarding to ***diabetes mellitus***. Our study showed that there was statistical significant difference between both diabetic and non-diabetic patients regarding to total cholesterol, LDL, TGs, waist circumference and low HDL> **Conclusion:** The youngest patients had a higher incidence of smoking, were mostly male, had a positive family istory of premature CAD, a low BMI, and had a poor lipid profile compared with other groups. In contrast, they had a lower incidence of other risk factors as diabetes, HTN, and low high□ density lipoprotein values. The oldest patients (group 4) had the lowest incidence of some risk factor as DM, HTN, smoking, total cholesterol (TCh), low low□density lipoprotein levels, waist circumference, and BMI, which gave rise to the suspicion that age alone is an important risk factor for CAD. Our study showed that there was no statistical significant difference between male and female regarding to the risk factors DM, HTN, smoking.
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Key work: Risk factors, Acute Coronary Syndrome

1. Introduction

The observed increase in the numbers of patients admitted with Acute Coronary Syndrome in Egypt has raised many questions about the precipitating factors and etiological background [**1**].

Patients with ACS include: unstable angina (UA), non ST elevation myocardial infarction (NSTEMI), and ST elevation myocardial infarction (STEMI). This ACS spectrum concept is a useful framework for developing therapeutic strategies [**1**].

Diagnosis of acute coronary syndrome (to be differentiated from other causes of acute chest pain) requires focused history including the risk factors analysis, physical examination, ECG, and serum level of the cardiac biomarkers [**2**].

A cardiovascular risk factor is a condition that is associated with an increased risk of developing CVD. The epidemiological studies selecting a group that is representative of the population to which the risk factors were correlated to get information about the development and the occurrence of the disease [**3**].

Many of those risk factors like age male sex and race cannot be changed (non modifiable cardiovascular risk factors), while tobacco smoking, diabetes mellitus (DM), high blood cholesterol, high blood pressure, obesity and physical activity are examples for modifiable cardiovascular risk factors [**4**].

Decreasing morbidity and mortality from CAD will necessitate the early diagnosis as well as early detection of risk factors for prevention of CAD and provide optimal care **[5]**.

Aim of the work

The aim of this work was to study the pattern of different risk factors such as age, sex, and family history of premature CHD, diabetes mellitus (DM), hypertension (HTN), smoking, dyslipidemia, obesity in patients with ACS of different age groups and sex

(focused on STEMI and NSTEMI) who were admitted in the coronary care unit in Mahalla cardiac center.

2. Patients and Methods

Study population:

This is a prospective study that was carried on 100 patients admitted to Coronary Care Unit at Mahalla cardiac center with acute coronary syndrome between the periods of MAY 2016 to JULY 2018.

Patients with ACS include those whose clinical presentations cover the following range of diagnoses: unstable angina, non–ST-elevation myocardial infarction (NSTEMI), and ST-elevation myocardial infarction (STEMI) and our study focused on STEMI and NSTEMI.

Then study population were divided into four groups according to their age based on age classification of Grace score which studied the impact of age on outcome of acute coronary syndrome outcome of patients with acute coronary syndrome.

The classification was:

1- Group 1: Age less than 45 years.
2- Group 2: Age from 45 to 54 years old.
3- Group 3: Age from 55 to 64 years old.
4- Group4: Age of 65 years and more.

Methods

All patients were presented within first 24 hrs of the onset of chest pain to obtain a reliable lipid profile otherwise other risk factors are assessed and the lipid profile was postponed one month later for the stability of lipid profile after the acute attack.

Data were analyzed using Statistical Program for Social Science (SPSS) version 23, NCSS version 12 and MedCalc version 15.4. Quantitative data were expressed as mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

3. Results

There was a significant difference between the studied groups as regards the prevalence of diabetes mellitus (DM), hypertension (HTN), and cigarette smoking and positive family history of premature CAD, with no significant difference as regards previous cardiac events.

Diabetes mellitus

Incidence of central obesity was more in diabetic patients (85 %) than non diabetic patients (78.3%) but differences of above parameters with diabetes were statistically non significant with p value >0.05 (Table 1).

Incidence of obesity was more in diabetic patients (40 %) than non diabetic (21.7%). This difference was statistically significant with p value <0.05.

The mean value of total cholesterol was more in diabetics (216.0 ± 30.2 mg/dl) than non diabetics (192.9 ± 20.9 mg/dl) Also the mean value of LDL cholesterol was more in diabetics (148.1 ± 29.9 mg/dl) than non diabetics (122.8 ± 21.4 mg/dl) and these differences was statistically highly significant (p-value <0.001).

The mean value of triglycerides was more in diabetics (181.3 ± 41.6 mg/dl) than non diabetics (159.2 ± 40.5 mg/dl) and the difference was statistically significant (p- value <0.05).

The mean value of HDL cholesterol was lower in diabetics (31.6 ± 8.6 mg/dl) than non diabetics (38.3 ± 8.4 mg/dl) and the difference was statistically highly significant (p- value <0.001).

The mean value of BMI was more in diabetics (28.3 ± 3.8) than non diabetics (27.5 ± 3.5) and these differences were statistically non significant (p- value > 0.05). and the mean value of waist circumference was more in diabetics (104.3 ± 7.8 cm) than non diabetics (98.9 ± 9.8) and these differences were statistically significant (p- value < 0.05).

Hypertension

Incidence of central obesity was more in hypertensive patients (85.7 %) than non-hypertensive (77.6%) and these differences were statistically non-significant with p value >0.05 and incidence of obesity was more in hypertensive patients (40.5 %) than non-hypertensive (20.7%) and these differences were statistically significant with p value = <0.05 (Table 2).

The mean value of total cholesterol was more in hypertensive (214.9 ± 30.3 mg/dl) than non-hypertensive (192.9 ± 20.8mg/dl) and the mean value of LDL cholesterol was higher in hypertensive (144.3 ± 28.9.5mg/dl) than non-hypertensive (124.7 ± 24.3 mg/dl) and these differences were statistically highly significant (p- value <0.001).

The mean value of triglycerides was more in hypertensive (185.5 ± 45.0 mg/dl) than non-hypertensive (155.3 ± 35.2 mg/dl) and the difference was statistically highly significant (p- value <0.001).

The mean value of HDL cholesterol was lower in hypertensive (33.5 ± 8.8 mg/dl) than non-hypertensive (37.1 ± 9.0 mg/dl) but the difference was statistically non-significant (p- value >0.05).

The mean value of BMI was higher in hypertensive (28.9 ± 3.5 mg/dl) than non-hypertensive (27.1 ± 3.5 mg/dl) and the difference was statistically significant (p- value <0.05).

The mean value of waist circumference was higher in hypertensives (103.9 ± 9.5 mg/dl) than non hypertensives (99.0 ± 8.9 mg/dl) but the difference was statistically significant (p- value <0.05).

Lipid profile and blood glucose

The mean value of total cholesterol of the whole group was 202.1 ± 27.4 mg/dl. It was (192.2 ± 11.5

mg/dl) in Group 1 increased in Group 2 (208.3 ± 18.9 mg/dl) and group 3 (219 ± 37.8 mg/dl) but decreased in Group 4 (188.7 ± 22.4 mg/dl). This difference was statistically significant (p- value <0.05) (Table 3).

The mean value of triglycerides of the whole group = 168.0 ± 42.2 mg/dl. It was (171.1 ± 23.4 mg/dl) in Group 1 increased in Group 2 (178.7 ± 35.3 mg/dl) and group 3 (185 ± 40.1 mg/dl) but decreased in Group 4 (139.4 ± 48.9 mg/dl). This difference was statistically highly significant (p- value <0.001).

The mean value of HDL of the study population was 35.6 ± 9.1 mg/dl. Its lower value was in group 1 (33.7 ± 8.4 mg/dl) and group 3 (33.9 ± 6.5 mg/dl) and its higher value was in group 4 (38.5 ± 8.9mg/dl). This difference was statistically non-significant (p- value >0.05).

The mean value of LDL cholesterol of the study population was 132.9 ± 27.9 mg/dl. It was (124.3 ± 15.4) in Group 1 which was lower than Group 2 (136.7 ± 22.9 mg/dl) and group 3 (148.1 ± 36.0 mg/dl) but higher than group 4 (122.3 ± 25.8 mg/dl). This difference was statistically highly significant (p- value <0.001).

The mean value of fasting blood glucose of the study population was 118 ± 30.7 mg/dl. It was (103.8 ± 30.6 mg/dl) in Group 1 which was lower than Group 2 (115.6 ± 33.1 mg/dl) and group 3 (130.7 ± 21.2 mg/dl) and Group 4 (120.2 ± 32.0 mg/dl). This difference was statistically highly significant (p- value <0.001).

The mean value of 2 hrs postprandial blood glucose of the study population was 195.3 ± 73.6 mg/dl. It was (157.6 ± 67.6 mg/dl) in Group 1 increased in Group 2 to (188.9 ± 66.8 mg/dl) and group 3 (231.8 ± 72.5 mg/dl) and was (198.4 ± 72.5 mg/dl) in Group 4. This difference was statistically highly significant (p- value <0.001).

Table 1 Comparison between the diabetics and non-diabetics regarding the lipid profile and anthropometric measures.

Lipid profile and anthropometric measures	Diabetic	Non-diabetic	Test	P-value (Sig.)
Count (%)	40 (40%)	60 (60%)		
T. Cholesterol (mg/dL)				
Mean ± SD	216.0 ± 30.2	192.9 ± 20.9	4.039 •	<0.001
Median (Range)	208.25 (163 – 317)	191.75 (140 – 237)		(HS)
HDL (mg/dL)				
Mean ± SD	31.6 ± 8.6	38.3 ± 8.4	-3.857 *	<0.001
Median (Range)	30.5 (18 – 54)	37.25 (22.5 – 63)		(HS)
LDL (mg/dL)				
Mean ± SD	148.1 ± 29.9	122.8 ± 21.4	4.218 •	<0.001
Median (Range)	144.5 (91.2 – 234.1)	123.15 (70.7 – 161.4)		(HS)
TGs (mg/dL)				
Mean ± SD	181.3 ± 41.6	159.2 ± 40.5	2.651 *	0.009
Median (Range)	186.25 (90 – 276)	148.75 (81 – 246)		(S)
BMI (Kg/m^2)				
Mean ± SD	28.3 ± 3.8	27.5 ± 3.5	1.260 •	0.208
Median (Range)	28.85 (20.1 – 33.7)	27.65 (20 – 34.7)		(NS)
Waist circumference (cm)				
Mean ± SD	104.3 ± 7.8	98.9 ± 9.8	2.885 •	0.004
Median (Range)	106 (90 – 118)	100.5 (70 – 118)		(S)
Waist hip ratio				
Mean ± SD	1.03 ± 0.18	0.95 ± 0.17	2.421 •	0.015
Median (Range)	0.995 (0.7 – 1.5)	0.945 (0.6 – 1.5)		(S)

• Mann Whitney U test. * Independent samples Student's t-test. p< 0.05 is significant. Sig.: significance.

Table 2 Comparison between the hypertensives and non-hypertensives regarding the lipid profile and anthropometric measures.

Lipid profile and anthropometric measures	Hypertensive	Non-hypertensive	Test	P-value (Sig.)
Count (%)	42 (42%)	58 (58%)		
T. Cholesterol (mg/dL)				
Mean ± SD	214.9 ± 30.3	192.9 ± 20.8	4.278 •	<0.001
Median (Range)	216 (160 – 317)	191.25 (140 – 365)		(HS)
HDL (mg/dL)				
Mean ± SD	33.5 ± 8.8	37.1 ± 9.0	-1.975 *	0.051
Median (Range)	33.75 (19 – 56)	35.75 (18 – 63)		(NS)
LDL (mg/dL)				
Mean ± SD	144.3 ± 28.9	124.7 ± 24.3	3.911 •	<0.001
Median (Range)	147.65 (85.2 – 234.1)	123.15 (70.7 – 209)		(HS)
TGs (mg/dL)				
Mean ± SD	185.5 ± 45.0	155.3 ± 35.2	3.762 *	<0.001
Median (Range)	194 (90 – 276)	146.5 (81 – 250)		(HS)
BMI (Kg/m²)				
Mean ± SD	28.9 ± 3.5	27.1 ± 3.5	2.843 •	0.004
Median (Range)	29.7 (20.0 – 33.7)	26.8 (20.1 – 34.7)		(S)
Waist circumference (cm)				
Mean ± SD	103.9 ± 9.5	99.0 ± 8.9	2.972 •	0.003
Median (Range)	106 (70 – 118)	100 (76 – 116)		(S)
Waist hip ratio				
Mean ± SD	1.02 ± 0.18	0.95 ± 0.18	2.585 •	0.010
Median (Range)	0.995 (0.6 – 1.5)	0.935 (0.7 – 1.5)		(S)

• Mann Whitney U test. * Independent samples Student's t-test. p< 0.05 is significant. Sig.: significance.

Table 3 Comparison between the studied groups regarding the lipid profile and blood glucose levels.

Lipid profile and blood glucose	All patients	G1 (<45 years)	G2 (45-54 years)	G3 (55-64 years)	G4 (>65 years)	Test	P-value (Sig.)
Count (%)	100 (100%)	22 (22%)	26 (26%)	25 (25%)	27 (27%)		
T. Cholesterol (mg/dL)							
Mean ± SD	202.1 ± 27.4	192.2 ± 11.5	208.3 ± 18.9	219 ± 37.8	188.7 ± 22.4	12.542 K	0.006
Median (Range)	198.5 (140 - 317)	193 (164 - 207)	204.5 (176 - 238)	216 (140 - 317)	188 (160 - 257)		(S)
HDL (mg/dL)							
Mean ± SD	35.6 ± 9.1	33.7 ± 8.4	35.8 ± 11.3	33.9 ± 6.5	38.5 ± 8.9	1.568 Ā	0.202
Median (Range)	35 (18-63)	31.5 (20-52)	35.25 (19-63)	35.5 (18-44.5)	38 (25-56)		(NS)
LDL (mg/dL)							
Mean ± SD	132.9 ± 27.9	124.3 ± 15.4	136.7 ± 22.9	148.1 ± 36.0	122.3 ± 25.8	20.889 K	<0.001
Median (Range)	131 (70.7-234.1)	123.8 (92.8-149.5)	137.25 (85-190.2)	152.4 (70.7-234.1)	120.4 (85.2-203.3)		(HS)
TGs (mg/dL)							
Mean ± SD	168.0 ± 42.2	171.1 ± 23.4	178.7 ± 35.3	185 ± 40.1	139.4 ± 48.9	7.230 Ā	<0.001
Median (Range)	168 (81-276)	172 (141-221)	190.5 (113-226)	184 (135- 276)	130 (81- 250)		(HS)
FBG (mg/dL)							
Mean ± SD	118 ± 30.7	103.8 ± 30.6	115.6 ± 33.1	130.7 ± 21.2	120.2 ± 32.0	26.464 K	<0.001
Median (Range)	117 (63-189)	92 (66-176)	111 (63-178)	137 (71-159)	117 (79-189)		(HS)
PPG (mg/dL)							
Mean ± SD	195.3 ± 73.6	157.6 ± 67.6	188.9 ± 66.8	231.8 ± 72.5	198.4 ± 72.5	20.889 K	<0.001
Median (Range)	176 (105-386)	127 (105-340)	176.5 (115-327)	239 (119- 386)	176 (115-360)		(HS)

K Kruskal Wallis test. A One-way Anova p< 0.05 is significant. Sig.: significance.

4. Discussion

Patients with ACS include those whose clinical presentations cover the following range of diagnoses: unstable angina, non–ST-elevation myocardial infarction (NSTEMI), and ST-elevation myocardial infarction (STEMI). This ACS spectrum concept is a useful framework for developing therapeutic strategies [**6**].

Risk factors as age; cigarette smoking; high blood pressure; elevated levels of LDL cholesterol; low levels of HDL cholesterol; family history of premature CHD; and high fasting plasma glucose levels are strongly associated with CHD. Age may be the only major risk factor that cause CHD by directly promoting atherosclerosis. Thus, increased age increases the risk of developing more severe CHD [**7**].

As regard ***diabetes mellitus*** our study population revealed that 40% of patients had diabetes mellitus (known by past history of DM or in hospital laboratory findings). The incidence of DM as a risk factor was lowest in the younger age group (representing 22% of patients < 45 yrs. old), increased through the groups then decreased again in the oldest age group.

That was in agree with results of **Gulf registry**, which showed that the prevalence of diabetes mellitus increased with age from 6% in young age group to 13% in oldest age group [**8**].

That was in agree with results of ***Reda et al,*** which showed that the prevalence of diabetes mellitus increased with age from 16% in young age group to 53% in oldest age group [**9**].

Al-Huthi et al, stated that in comparison between developed and developing countries, we found that prevalence of DM is much higher in Egyptian population, 22% in Bahrain and 28% in Yemen [**10**].

Paneni et al, found that compared with patients without diabetes, those with diabetes have greater de novo disease progression and higher cardiovascular mortality rates. Diabetes is associated with a 2- to 4-fold increase in the risk of developing coronary artery disease [11].

As regard ***hypertension*** we found that 42% of our study population had past history of hypertension but the incidence was low in the younger age group and that incidence increased with age but declined again in the oldest group patients.

That was in agreement with the results ***Rosengren1 A. et al***, in the **Euroheart ACS survey** found overall prevalence of HTN was (48%) and it was lowest in the youngest group and increased with age then decreased again in the oldest two age groups [12].

That was in agreement with the results of ***Reda et al,*** which showed that the prevalence of hypertension increased with age them decreased again in the oldest age group [9].

The prevalence of past history of hypertension among ACS ***Al-Huthi et al***, found prevalence of HTN among the ACS patients in Bahrain was (44%) and Yemeni patients was 47.1%. [**10**].

Hypertension is a strong independent risk factor for the development of cardiovascular disease (CVD) and strongly predicts mortality across populations. These findings emphasize the need for new blood pressure-lowering strategies, and will help to inform the design of randomized trials to assess them [**13**].

Regarding the ***lipid profile***, in the present study mean total **cholesterol** was 202.1±27.4 mg/dl in the whole study population. The mean value increased with age but it decreased again in the oldest age group.

As regard the mean value of **triglycerides** level it was 168±42.2 mg/dl. The mean value increased with age from the youngest group to the group 3 then decreased again to its lowest value in the oldest age group.

Haque et al, agreed with our results and found that TGs increase gradually in men until about age 50 years and then mildly decline. The risk of the rise in serum cholesterol with an increase in LDL-C and decrease HDL-C assume a great significance since this has been the pattern associated with CHD [**14**].

As regard the mean value of **HDL** it was 35.6±9.1 mg/dl for the whole study population. There was low HDL value in almost all groups except the oldest one (>65y). The lowest HDL value was in the youngest group (<45y).

As regard mean value of **LDL** it was 132.9±27.9 mg/dl for the whole study population. It increased with age but again it decreased to reach the lowest value in the oldest age group (>65y).

On the other hand, ***Kwame et al,*** Found that the mean total cholesterol (190 mg/dl), low-density lipoprotein (LDL) cholesterol (126mg/dl), and HDL cholesterol (43 mg/dl). So the lipid parameters showed slightly lower values than we had in our study [**15**].

In the **Prospective Cardiovascular Munster study,** also against our study, a large observational study, mild hypertriglyceridemia (TGs >200 mg/dL) was more prevalent in men (18.6%) than in women (4.2%) [**16**].

In contrast to our study, ***Rosengren1 A. et al,*** found that distribution of patients with dyslipidemia was highest in the younger group and decreased with advancement of age from 53.2% in the youngest group to 21.3% in the oldest group [**12**].

Summary and Conclusion

The present study involves screening of the pattern of these risk factors and its difference among age groups from which we found that:

- Male gender as a risk factor was more prominent in younger age groups and decreased with age.
- Family history of either premature coronary artery disease or sudden cardiac death had the highest prevalence among the youngest age group and decreased with age.
- Diabetes mellitus, hypertension, and obesity was of higher prevalence among the age groups2 & 3 and it was lower in the youngest and oldest age groups.
- Current cigarette smoking was more prevalent in the youngest age groups and decreased in older age groups.

Group 1 had fewer risk factors as they represented the lowest incidence of diabetes mellitus, hypertension and obesity. In addition they had better pattern of lipid profile than the other groups. In contrast they had increased incidence of other risk factors as positive family history of premature CAD, higher incidence of current smoking, low HDL value and being male sex.

The age groups 2 & 3 always show the highest incidence of many risk factors as DM, HTN, obesity, central obesity and atherogenic lipid profile.

The age group 4 showed decrease of the prevalence of risk factors as DM, HTN, obesity, low HDL, high LDL, high TGs, smoking and family history than other age groups which may raise the suspicion that age alone is the most important risk factor.

Urban patients have more levels of TCh, LDL, TGs, HDL and it was of statistical significance and higher BMI and waist circumference than rural patients but it wasn't of statistical significance.

Diabetic patients have significantly higher mean levels of TCh, LDL, obesity than non-diabetics and significantly higher values of TGs and lower values of HDL than other non-diabetic group.

Hypertensive patients had significantly higher mean levels of TGs, cholesterol, LDL, TG and obesity than non-hypertensive group.

The incidence of STEMI was higher in the youngest age group and decreased in older age groups while the incidence of NSTEMI was higher among older age groups.

The incidence of in hospital complications and mortality rate was higher among the oldest age groups with deceased incidence among the youngest one, as we had found that the occurrence of heart failure, acute MR, AF increases with age advancement and each of mortality, resuscitation, CVA, VT, VF, MR, AF and shock didn't occur in the youngest group and showed higher percent as age advances.

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