ORIGINAL ARTICLE
COMMON RISK FACTORS INVOLVED IN THE DEVELOPMENT OF MYOCARDIAL INFARCTION IN ADULTS YOUNGER THAN 45 YEARS OF AGE

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Background: Pakistan has got a very high prevalence of myocardial infarction (MI). MI presents at pretty young age in this country. The objective of present study was to determine the frequency of common risk factors associated with early development of MI in middle aged adults of less than 45 years. **Methods:** It was a cross sectional study conducted in the Cardiology department of Ayub Teaching Hospital (ATH) Abbottabad from 23rd June 2015 – 10th July 2016. A total of 255 consecutive patients diagnosed with MI admitted to the Cardiology Unit of ATH, Abbottabad. A detailed medical history and general physical examination of the patients was carried out with an emphasis on recording the presence or absence of common risk factors of MI in these patients. All routine investigations (Blood Complete Picture, Urea, Creatinine, Blood Sugar & Lipid Profile) were done. **Results:** Mean age of the subjects was 39.98±4.61 SD. The frequency of risk factors in descending order was smoking in (38.8%), obesity in (29.4%) and essential hypertension in (21.6%) of the patients. Other risk factors of MI in this study were diabetes mellitus (19.2%), family history of ischemic heart disease (IHD) was (18.8%) and disproportionate dyslipidemias in (12.9%). Sex of patients (male predominance) was found to be significantly associated with diabetes, smoking and dyslipidemia ($p<0.05$). **Conclusion:** Male sex, smoking, hypertension and obesity confer an increased risk of myocardial infarction in patients younger than 45 years of age.

Keywords: Myocardial Infarction; Smoking; Hypertension; Prognosis; Ischemic heart disease

INTRODUCTION

Myocardial Infarction (MI) is among the leading cause of deaths in the developed western countries.[1] According to one estimate, it has been observed that more than 300,000 patients are diagnosed with ST-segment elevation MI (STEMI) and 400,000 people suffer from the non ST-segment elevation MI (NSTEMI) all over the world each year.[2] Pakistani population accounts in that ethnic group which shows the highest prevalence of coronary artery disease (CAD) compared to the rest of the world population .It is quite frequent that MI presents at comparatively younger age group in our country and it follows a more aggressive clinical course and adverse outcome. In Pakistan the death rate from CAD is estimated to be about 410 per 100,000 country's population.[3]

Regarding CAD in our country, it has been observed that the prevalence of MI is 11.2% in Pakistan and there is a slight female preponderance (13.3%) as compared to men (7.9%). In addition, other South Asian countries like India, Nepal, Bangladesh and Sri Lanka account for about one quarter of the world's total population and likewise share the highest proportion of CAD burden including both STEMI and NSTEMI, compared with any other under developed regions globally.[4] Among the many predisposing factors of CAD, advanced age is one of the well-established risk factors for acute MI.[1]

Although It has been recognized that the true incidence of acute MI is less in patients with age less than 45 years when actually compared with elderly subjects[5] but, in some low income regions and middle class subjects, changing lifestyles, economic pressures, and other stressful factors may be contributing to increased CAD incidence in middle aged adults, and leading towards remarkable change in the last three decades paradigm of CAD which was once considered as a disease of the affluent culture and the older ones.[6,7] The incidence of acute

myocardial infarction has been reported to be as low as 2–6% in individuals aged 45 years or less.[5] Recently, it has been evidenced by the results of various studies that 16.1% of the all population with diagnosed IHD were of the age younger than 45 and 19% of the patients with IHD were younger than 40 years in our country.[6–8]

Compared to the elderly patients, the documented incidence of acute MI is 8 times lower in younger population. The reason being that protection often considered to be offered by young age is slowly taken away by increased exposure to risk factors due to changing lifestyles in younger adults.[1] Secondly, there are no typical warning signs preceding an acute MI in young patients in whom sudden severe attack of acute angina pectoris may hastily lead to acute attack of severe MI.[1]

In addition, prevalence of smoking in all forms is 73-90% in patients of younger age group, which has got a well-established association with IHD[1], the list of other risk factors includes hypertension in 30%, dyslipidemia in 22%, and diabetes mellitus in 21% (metabolic syndrome) and family history of IHD in 24 % of the patients.[1] The objective of our study was to determine the frequency of such risk factors of CAD in patients younger than 45 years in this part of country. Results add to existing body of knowledge and local evidence is created.

MATERIAL AND METHODS

It was a cross sectional study conducted in the Cardiology department of Ayub Teaching Hospital (ATH) Abbottabad during a period of one year (23rd June 2015 – 10th July 2016) in which 255 consecutive patients aged 45 years or less with acute myocardial infarction were enrolled. Sample size was calculated using WHO software for sample size determination assuming with 95% confidence interval and 5% margin of error taking 21% prevalence of diabetes as anticipated proportion. Sampling was done through consecutive non-probability sampling technique.

Patients of both sexes who had been diagnosed with acute MI (Chest pain of greater than 30 minutes' duration and not relieving by two doses of Glyceryl Tri-nitrate with evidence of ECG having ST segment elevation of 2 mm or more in two consecutive precordial leads or 1 mm or more in contiguous limb leads) were included in the study. Age of the patients was between 18 and 44 (mean 39.98±4.61 SD) years. Fully informed and written consent was taken from all patients before inclusion in the study. The patients work up started with detailed history (family history, drugs, diabetes mellitus, smoking, hypertension and dyslipidemias by the scrutiny of past medical records if available). General clinical examination in detail and all routine biochemical markers (Blood Complete Picture, Urea, Creatinine, Blood Sugar & Lipid Profile) were estimated in the Department of Pathology, Ayub Medical College Abbottabad. All the patients were under the management of strict hospital protocols and supervision of a consultant cardiologist with at least five years' experience in the relevant field. Data was recorded on a standardized predesigned *pro forma*. Statistical analysis was performed by SPSS version 20, *P*-value ≤ 0.05 was taken as statistically significant using Chi square test was used at 5% significance level.

RESULTS

The mean age of the study participants was 39.98±4.61 in years. Rest of basic data is given in Table-1. Frequency of various risk factors is given in Table-2.

When the risk factors for myocardial infarction in the study population were stratified against age and sex of study population, it is observed that sex of study participants was found to be significantly associated with risk factors like, diabetes mellitus, dyslipidemia and smoking ($p<0.05$). (Table-3), whereas no significant association was noted between the age of study participants and common risk factors for MI in this study (Table-4).

Table-1: Biochemical and physiological characteristics of study participants (n=255)

Parameter	Minimum	Maximum	Mean	± Standard Deviation
Age (years)	23	44	39.98	4.61
Weight (Kilograms)	52	106	75.21	12.66
Height (meters)	1.50	1.90	1.65	0.083
Body Mass Index	19.03	42.22	27.75	5.92
Fasting Plasma glucose mmol/l	3.40	26.42	6.43	4.02
Serum Triglycerides (mmol/l)	.60	13.00	1.74	1.16
Fasting HDL (mmol/l)	.55	5.30	1.59	0.56
Fasting total cholesterol (mmol/l)	2.70	8.40	4.7043	0.87
Systolic BP (mmHg)	0020100	200	123.88	21.46
Diastolic BP (mmHg)	50	130	79.98	13.54

Table-2: Frequency of various risk factors in study participants N (%)

Sex		Frequency N	Percent %
	Male	206	80.8
	Female	49	19.2
	Total	255	100.0
Hypertension			
	Yes	55	21.6
	No	200	78.4
	Total	255	100
Diabetes Mellitus (DM)			
	YES	49	19.2
	NO	206	80.8
	Total	255	100
Dyslipidemia			
	Yes	33	12.9
	No	222	87.1
	Total	255	100
Smoking			
	Yes	99	38.8
	No	156	61.2
	Total	255	100
Family history of IHD			
	Yes	48	18.8
	No	207	81.2
	Total	255	100
Obesity			
	Yes	75	29.4
	No	160	70.6
	Total	255	100

Table-3: Cross tabulation of age and common risk factors for myocardial infarction

Study Parameter		Hypertension		Total	p value
		Yes	No		
Age	< 40 years	26	105	131	0.49
	> 40 years	29	95	124	
Total		55	200	255	
		Diabetes Mellitus		Total	p value
		Yes	No		
Age	< 40 years	21	110	131	0.18
	> 40 years	28	96	124	
Total		49	206	255	
		Dyslipidemia		Total	p value
		Yes	No		
Age	<40 years	21	110	131	0.131
	> 40 years	12	112	124	
Total		33	222	255	
		Smoking		Total	p value
		Yes	No		
Age	< 40 years	50	81	131	0.83
	> 40 years	49	75	124	
Total		99	156	255	
		Family History of IHD		Total	p value
		Yes	No		
Age	< 40 years	27	103	130	0.43
	> 40 years	21	103	124	
Total		48	206	254	
		Obesity		Total	p value
		Yes	No		
Age	< 40 years	36	95	131	0.43
	> 40 years	39	85	124	
Total		75	180	255	

$p \leq 0.05$ is significant.

Table-4: Cross tabulation of sex of study participants and common risk factors for myocardial infarction

Study Parameter		Hypertension		Total	p value
		Yes	No		
Sex	Male	42	164	206	0.35
	Female	13	36	49	
Total		55	200	255	
		Diabetes Mellitus		Total	p value
		Yes	No		
Sex	Male	29	177	206	**0.00**
	Female	20	29	49	
Total		49	206	255	
		Dyslipidemia		Total	p value
		Yes	No		
Sex	Male	20	186	206	**0.002**
	Female	13	36	49	
Total		33	222	255	
		Smoking		Total	p value
		Yes	No		
Sex	Male	99	107	206	**0.00**
	Female	00	49	49	
Total		99	156	255	
		Family History of IHD		Total	p value
		Yes	No		
Sex	Male	37	179	206	0.27
	Female	12	37	49	
Total		49	206	255	
		Obesity		Total	p value
		Yes	No		
Sex	Male	59	147	206	0.58
	Female	16	33	49	
Total		75	180	255	

DISCUSSION

Although CHD primarily considered as the disease of patients over the age of 40, but patients younger than 40–45 years of age can also be affected due to changes in lifestyles. Most of the studies have used an age cut-off point of 40 to 45 years to define "young" patients with CHD or acute MI.[9–11] The data available on the frequency of MI in younger patients is sparse and it is an uncommon entity in them, it is an important because of the devastating effect of CHD on the more active lifestyle of younger patients. Overall, males comprised of 80.8% of our study population confirming the earlier notion that CHD is a male disease as earlier literature reports.[9] Cigarette smoking is uniformly the most common risk factor in many surveys, with an incidence ranging from 70% to greater than 90%.[10,11] The situation was quite different in our study where only 38.8% study participants reported to have smoked tobacco. Although there can be many explanations to this finding, e.g., tobacco is used in many forms in this region such like snuff or in "*hookah*", therefore many patients, despite probably using tobacco in the form of snuff might have reported themselves as non-smokers.

A family history of coronary heart disease considered one of the most relevant risk factors for the early onset of AMI was seen in 20.7% of study population less than 40 years as compared to 16.9% in over 40 years' age. Although statistically not significant (p value 0.43) but recently it has been widely studied that genetic background have a definitive play a role in the risk of AMI.[12,13].

Finally, the hypertension, dyslipidemia and diabetes mellitus (DM) three conventional risk factors, are not as prevalent in younger age groups as they are in older ones (p value 0.49, 0.131 and .18) respectively in our study. This observation is consistent with several studies.[14] For stroke and coronary heart disease in addition to frank diabetes mellitus.[14] Although DM was present in about one-fifths of study population (n=49; 19.2%) the role played by fasting blood glucose levels in elevating the risk for future CAD is well extablished.[14] A recently published study by Park et al. which explored the relationship between fasting plasma glucose and risk of coronary disease. This led the researchers to conclude that both low plasma glucose and impaired fasting plasma glucose are considered as predictors of risk of cardiovascular events.[14,15] A recent study from Singapore.[15] reported that younger patients with MI in Singapore were characterized by male predominance who were smokers and obese. This finding is not consistent with our study where results for obese (BMI greater than 30) was

statistically non-significant (*p* value 0.43 Table-3).

The low incidence of AMI in women of our study population limited the possibility investigating their risk profile adequately. In this study, this small sub-population have an additional risk factor that is oral contraceptives: but this study neither takes into account their use of oral contraceptive pills nor excludes them. Therefore, the role of these agents cannot be ascertained especially when concomitant use of tobacco and oral contraceptives can have a synergistic effect. However, none of our female study participants reported having used tobacco in any form. All patients who reported smoking were males so gave non-significant results. However, the incidence of dyslipidemia and DM was significant in both genders consistent with other studies. [16–18]

CONCLUSION

Among the conventional, modifiable risk factors smoking, hypertension, obesity, diabetes mellitus and dyslipidemias are most frequently encountered in young people and are needed to be potentially focused upon by the physicians to halt the progression of CAD in younger population.

AUTHORS' CONTRIBUTION

FI: Concept and design, data acquisition and interpretation, analysis. ST: Data interpretation, analysis, write-up, literature search, proof reading. SF: Data entry, analysis by SPSS, literature search, proof reading. MO: Literature search, data collection, literature search. RN: Data collection, analysis, proof reading. AR: Literature search proof reading.

REFERENCES

1. Jamil G, Jamil M, Alkhazraji H, Haque A, Chedid F, Balasubramanian M, *et al*. Risk factor assessment of young patients with acute myocardial infarction. Am J Cardiovasc Dis 2013;3(3):170–4.
2. Beltrame JF, Dreyer R, Tavella R. Epidemiology of coronary artery disease [Internet]. INTECH Open Access Publisher; 2012 [cited 2016 Jul 17]. Available from: www.intechopen.com/download/pdf/32288
3. Iqbal MA, Rauf MA, Faheem M, Shah I, Khan N, Khan SB, *et al*. Comparison of in-hospital outcome of acute inferior myocardial infarction complicated by right ventricular infarction with isolated acute inferior myocardial infarction. Pak Heart J 2013;45(4):225–30.
4. Ullah I, Ali J, Faheem M, Qureshi S, Shah SFA, Khan SA, *et al*. Frequency of complete heart block and in-hospital mortality in patients with acuteac anterior wall myocardial infarction. Pak Heart J 2013;45(4):249–55.
5. Yunyun W, Tong L, Yingwu L, Bojiang L, Yu W, Xiaomin H, *et al*. Analysis of risk factors of ST-segment elevation myocardial infarction in young patients. BMC Cardiovasc Disord 2014;14(1):179.
6. Moran AE, Forouzanfar MH, Roth GA, Mensah GA, Ezzati M, Murray CJL, *et al*. Temporal trends in ischemic heart disease mortality in 21 world regions, 1980 to 2010: The Global Burden of Disease 2010 study. Circulation 2014;129(14):1483–92.
7. Iqbal MA, Hadi A, Farooq M, Khan N, Wahid I, Hafizullah M. Frequency of conventional risk factors among coronory artery disease patients in tribal area of Pakistan. Pak Heart J 2014;47(3):132–6.
8. Islam F, Khan A, Naz S, Said AB. Risk Factors Associated with Ischemic Heart Diseases in Different Age Groups Patients Admitted to Tertiary Care Hospitals of Peshawar. Int J Innov Res Devel 2015;4(5):8–11.
9. Incalcaterra E, Caruso M, Lo Presti R. Myocardial infarction in young adults: risk factors, clinical characteristics and prognosis according to our experience. Clin Ter 2013;164(2):e77–82.
10. Pineda J, Marín F, Roldán V, Valencia J, Marco P, Sogorb F. Premature myocardial infarction: clinical profile and angiographic findings. Int J Cardiol 2008;126(1):127–9.
11. Anderson RE, Pfeffer MA, Thune JJ, McMurray JJV, Califf RM, Velazquez E, *et al*. High-risk myocardial infarction in the young: the VAL sartan in Acute myocardial iNfarcTion (VALIANT) trial. Am Heart J 2008;155(4):706–11.
12. Gaeta G, De Michele M, Cuomo S, Guarini P, Foglia MC, Bond MG, *et al*. Arterial abnormalities in the offspring of patients with premature myocardial infarction. N Engl J Med 2000;343(12):840–6.
13. Topol EJ, McCarthy J, Gabriel S, Moliterno DJ, Rogers WJ, Newby LK, *et al*. Single nucleotide polymorphisms in multiple novel thrombospondin genes may be associated with familial premature myocardial infarction. Circulation 2001;104(22):2641–4.
14. Park C, Guallar E, Linton JA, Lee DC, Jang Y, Son DK, *et al*. Fasting Glucose Level and the Risk of Incident Atherosclerotic Cardiovascular Diseases. Diabetes Care 2013;36(7):1988–93.
15. Wong CP. Acute myocardial infarction: Clinical features and outcomes in young adults in Singapore. World J Cardiol 2012;4(6):206–10.
16. Dreyer RP, Wang Y, Strait KM, Lorenze NP, D'Onofrio G, Bueno H, *et al*. Gender differences in the trajectory of recovery in health status among young patients with acute myocardial infarction: results from the variation in recovery: role of gender on outcomes of young AMI patients (VIRGO) study. Circulation 2015;131(22):1971–80.
17. Johnson BD, Shaw LJ, Buchthal SD, Bairey Merz CN, Kim HW, Scott KN, *et al*. Prognosis in women with myocardial ischemia in the absence of obstructive coronary disease: results from the National Institutes of Health-National Heart, Lung, and Blood Institute-Sponsored Women's Ischemia Syndrome Evaluation (WISE). Circulation 2004;109(24):2993–9.
18. Hamelin BA, Méthot J, Arsenault M, Pilote S, Poirier P, Plante S, *et al*. Influence of the menstrual cycle on the timing of acute coronary events in premenopausal women. Am J Med 2003;114(7):599–602.

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