INTRODUCTION

Coronary artery disease (CAD) remains the commonest cause of mortality worldwide. South Asians are prone to develop advanced atherosclerosis and highest mortality rate due to its complications compared to other ethnic groups studied. It has been documented that younger age group people are developing the diseases frequently than before in last couple of years. Various studies show that in comparison with older patients these patients have single vessel disease, has
more profound hypercholesterolemia, significant positive family history and history of smoking. There are a number of such studies from developed countries but only a few from Pakistan.

Coronary heart disease mortality is generally accepted as an indicator of socio-economic conditions. In a changing social environment, early detection and treatment of youths at risk of premature IHD offers the greatest promise and an opportunity for age-specific interventions. Moreover, the potential gains from controlling major established risk factors could be substantial in South Asians and greater than that in Europeans.

The purpose of this study was to evaluate different risk factors prevailing in patients below 45 years of age suffering from coronary heart disease.

**METHODOLOGY**

All consecutive patients age below 45 years, having classical history of Ischemic heart disease and also having definite ECG changes consistent with coronary artery disease (recent / old) were enrolled. These patients were admitted to CCU/Intermediate Coronary Care Unit of Pakistan ordinance factories (POF) Hospital Wah Cantonment from April 2007 to December 2011. POF Hospital Wah Cantonment is 620 bedded tertiary care centre for the employees and their dependents, civilians living at POF Wah cantonment and tertiary care referral hospital for POF Sanjwal cantonment and POF Havelian cantonment.

In total one hundred and nine (109) patients were included in the study. Patients who had doubtful history as regards coronary heart disease and those having ECG changes not classically consistent with CAD were excluded. The patients were divided into 4 groups on the bases of age; group1, <30 years; group2, between 31-35 years; group3, between 36-40 years and group 4 between 41- 45 years.

A detailed comprehensive Performa was filled by our trained doctors regarding history including family history and details of risk factors. Clinical examination was carried out and relevant investigations including the serial ECG changes were recorded. Blood samples were collected after an overnight fast of 14 hours and tests were done for total cholesterol and HDL cholesterol by using Pioneer-USA, linear chemical kits by cholesterol oxidase and enzymatic calometric method.

The patients were considered suffering from hypertension once the patient was on antihypertensive medications at the time of admission or the past medical history / record documented raised BP at multiple occasions or the BP was recorded higher (>140/90 mmHg) at separate occasions while remained admitted. Diabetes Mellitus was considered to be present when either patient was taking any anti-diabetic agents or blood glucose was found to be > 126 mg/ dl fasting or > 200 mg/dl at random sample at more than 02 occasions.

Cigarette smoking was labeled if the patient had smoked within last 03 years. Family history of ischemic heart disease was considered positive when any close relative <55 years of age in males or <65 years in female had history of angina pectoris or myocardial infarction in past.

Dyslipidemia was considered when total cholesterol was found more than 5.2 - 6.5mmol/L (200 mg/dl) and high density lipoproteins (HDL) <1.0 mmol/L (≤ 40 mg/dl). The data was processed on SPSS Statistics v16.

**RESULTS**

The study comprised of 109 patients with mean age 41 years. There were 67 males (61%) and 42 females (39%) (Table-I). Males mean age was 42 years and females mean age was 41 years. Further divisions of patients were made according to age in 4 groups. Group 1, age < 30 years had a total of 04 (02 males & 02 female). Group 2, ages from 31- 35 years had a total of 11 (08 males and 03 females), group

| Table-I: Distribution according to gender & age. |
|-----------------------------------------------|
| **Total** | **Gender** | **Male** | **Female** |
| **Count** | **%** | **Table N %** | **Count** | **Table N %** |
| Age Category(years) <=30 | 4 | 3.7% | 2 | 1.8% | 2 | 1.8% |
| 31-35 | 11 | 10.1% | 8 | 7.3% | 3 | 2.8% |
| 36-40 | 24 | 22.0% | 12 | 11.0% | 12 | 11.0% |
| 41-45 | 70 | 64.2% | 45 | 41.3% | 25 | 22.9% |
| Total | 67 | 61.5% | 42 | 38.5% |
3, ages from 36-40 years had a total of 24 (12 males and 12 females). Group 4, ages from 41-45 years had a total of 70 (males 45 and females 25). Majority of the patients were in group 4 (64.2%). (Table-I)

Smoking was documented in 50 patients (45.9%). Forty seven (43.1%) were males and only 3 (2.8%) were females. Eighty percent of the smokers were in age group 4. Strong family history for CAD was noted in 47 patients (43.1%), 28 (25.7%) were males and 19 (17.4%) was females. (Table II & III)

Hypertension was noted in 40 patients (36.7%). Twenty two (20.2%) were males and 18 (16.5%) were females. Seventy five percent of the hypertensive patients were in age group 4. Dyslipidemia was noted in 33 (30.3%) patients and of these 21 (19.3%) were males and 12 (11%) females. Average serum cholesterol was 5.85 mmol/L and HDL was 1.005 mmol/L. Fifty eight percent of the patients with dyslipidemias were in age group 3 and 15% of patients were in group 2. Diabetes Mellitus was noted in 20 patients (18.3%). Males were 15 (13.8%) and females 5 (4.6%). Seventy percent of the diabetics were in age group 4. (Table II & III)

Forty five percent were overweight with BMI 25-29.9 Kg/m². Majority of these patients were in age groups 3 and 4. A reasonable number of patients (15.6%) had class I obesity (BMI 30-34.9 Kg/m²). Only 35.8% patients had normal weight and had normal BMI (18-24.9 Kg/m²). (Table-IV)

Abdominal girth was noted to be an important risk factor and at times operate independent of obesity (Increased BMI). Fifteen cases with 36-40 inches abdominal girth were noted with normal BMI (18-25 Kg/m²), 37 patients had girth of 36-40 inches while having BMI 26-30 Kg/m² and 08 patients had abdominal girth of 36 - 41 inches while having BMI of 26-30 Kg/m². Only 04 patients had 41-45 inches of abdominal girth. (Table-IV)

Casual dietary habits were noted in 67 (61.5%), of these 38 (34.9%) were males and 29 (26.6%) were

---

**Table-II: Distribution of risk factors according to gender.**

| S. No. | Gender | Count | Table N% | Gender | Count | Table N% | Total | Count | % |
|--------|--------|-------|----------|--------|-------|----------|-------|-------|---|
| a.     | Smoking | Yes   | 47       | 43.1%  | 3      | 2.8%     | 50    | 45.9% |
|        | No      |       | 20       | 18.3%  | 39     | 35.8%    | 59    | 54.1% |
| b.     | Family History | Positive | 28 | 25.7% | 19 | 17.4% | 47 | 43.1% |
|        |         | Negative | 39       | 35.8%  | 23     | 21.1%    | 62    | 56.9% |
| c.     | Hypertension | Yes | 22       | 20.2%  | 18     | 16.5%    | 40    | 36.7% |
|        | No      |         | 45       | 41.3%  | 24     | 22.0%    | 69    | 63.3% |
| d.     | Dyslipidemias | Yes | 21       | 19.3%  | 12     | 11.0%    | 33    | 30.3% |
|        | No      |         | 46       | 42.2%  | 30     | 27.5%    | 76    | 69.7% |
| e.     | Diabetes Mellitus | Yes | 15       | 13.8%  | 5      | 4.6%     | 20    | 18.3% |
|        | No      |         | 52       | 47.7%  | 37     | 33.9%    | 89    | 81.7% |
| f.     | BMI (Kg/m²) | <18.50 | 1       | 0.9%   | 0      | 0.0%     | 1     | 0.9% |
|         |         | Normal (18.5-24.9) | 30       | 27.8%  | 9      | 8.3%     | 39    | 35.8% |
|         |         | Overweight (25-29.9) | 25       | 23.1%  | 24     | 22.2%    | 49    | 45.0% |
|         |         | Class I Obesity (30-34.9) | 8       | 7.4%   | 9      | 8.3%     | 17    | 15.6% |
|         |         | Class II Obesity (35-39.9) | 1       | 0.9%   | 0      | 0.0%     | 1     | 0.9% |
|         |         | Class III Obesity >40 | 1       | 0.9%   | 0      | 0.0%     | 1     | 0.9% |
| g.     | Abdominal Girth (inches) | 31-35 | 18       | 18.6%  | 2      | 2.1%     | 20    | 18.3% |
|         |         | 36-40   | 30       | 30.9%  | 34     | 35.1%    | 64    | 58.7% |
|         |         | 41-45   | 8        | 8.2%   | 3      | 3.1%     | 11    | 10.1% |
|         |         | 46-50   | 2        | 2.1%   | 0      | 0.0%     | 2     | 1.8% |
| h.     | Diet | Good | 29       | 26.6%  | 13     | 11.9%    | 42    | 38.5% |
|         |         | Bad | 38       | 34.9%  | 29     | 26.6%    | 67    | 61.5% |
| i.     | Lifestyle | Active | 29       | 26.6%  | 5      | 4.6%     | 34    | 31.2% |
|         |         | Sedentary | 38       | 34.9%  | 37     | 33.9%    | 75    | 68.8% |
| j.     | Work/Job | Executive | 10       | 9.2%   | 1      | 0.9%     | 11    | 10.1% |
|         |         | Office work | 24       | 22.0%  | 4      | 3.7%     | 28    | 25.7% |
|         |         | Manual work | 32       | 29.4%  | 0      | 0.0%     | 32    | 29.4% |
|         |         | Housewife | 0       | 0.0%   | 38     | 34.0%    | 38    | 34.9% |
females. Eighteen percent patients with casual dietary habits had BMI in normal limits while 42% of patients had increased BMI above the normal (<24.9Kg/m2).

Active lifestyle was noted in 34 (31.2%) patients, 29 (26.6%) were males and 5 (4.6%) were females. Majorities (68.8%) of the patients had sedentary lifestyle and were distributed equally in both sexes. Thirty four percent of males and only 5% females were employed in executive or sedentary office jobs. Thirty eight (95%) females were housewives. Thirty two patients were manual workers and belonged to lower socio-economic class.

**DISCUSSION**

The prevalence of coronary heart disease has been tremendously increasing in last decade. In this study there were 61% males compared to 39% females. In studies done earlier in Pakistan the female population was lower which was probably due to sample selection bias as the patients were recruited from angiography units and not from the coronary care units.8,9

Smoking is important and modifiable risk factor known for CAD.10 Our data shows that the smoking was the dominant risk factor (46%). Only 3% females smoked. Several other studies have shown smoking as the most important risk factor among the younger patients with CAD.11 Pais et al has shown it to be the most dominant risk factor in Indian population studied.12 Our study also demonstrates that cigarette smoking was the dominant risk factor predisposing to an earlier onset of CAD, in line with previous studies.13,14
The Framingham study shows the mechanism of this correlation; that cigarette smoking is strongly associated with “atherogenic” lipoprotein cholesterol profiles in young adults. This signifies the fact that cessation of smoking may be the most cost effective approach in primary and secondary prevention.

We have observed that hypertension was the second commonest risk factor (37%) and was equally distributed in both sexes. The exact mechanism through which systemic hypertension induces MI has not been studied in detail, but there is evidence that Hypertension causes LV Hypertrophy and progression of atherosclerosis resulting in CAD. Diabetes mellitus was noted in 17%. The disease is more prevalent in males (14%) compared to females (4%) and in older patients as compared to younger patients. This fact has been documented in a number of previous studies.

Higher BMI was documented in 46% of patients. Sixteen were obese. There was no statistical difference comparing males with females. Asians have a higher body fat percentage for a given BMI than other ethnic groups. Prevalence of obesity and overweight is low, while DM and HTN occur at a lower level of BMI compared to western population. It has been suggested that Asians have a different fat distribution pattern and are more prone to central obesity at low BMI levels.

Increased cholesterol was noted in 33 (33%) patients. Hypercholesterolemia mainly increased LDL and decreased HDL are important risk factors. It is documented that South Asians have total cholesterol, LDL-C levels comparable to Afro-Caribbean’s and whites but they do have higher Triglycerides and low HDL-C levels. In another study done in India has shown that mean TC in Indians is usually below 200 mg/dl but ratio of TC/HDL-C is significantly lower. In our patients hypercholesterolemia was highest (73%) in group 4, which is comparable to the findings of Yildirim et al. In another study, no graded strength of association of hypercholesterolemia with coronary artery disease could be observed. It has also been observed that in South Asians, CAD occurs at a much lower level of total cholesterol than other populations.

The mechanism of such an observation could be explained by a study showing that the serum HDL cholesterol of South Asians is comparable to that of other populations, only the small HDL particle size is predominant in them, which does not confer protection against CAD.

Strong family history was noted in 47% of patients which was equally noted in both males and females and appears to be another important risk factor. This fact was also highlighted in another study done in India.

There have been several studies to explain the mechanism of this correlation. In a study to detect the cardiovascular risk in young adults, it was found that young subjects with a positive family history of CAD had greater sub-clinical atherosclerosis (IMT) compared to those with negative history. The association between the number of risk factors and IMT was stronger in subjects with a family history than those without. It has also been observed that subjects with a family history of CAD had higher prevalence of coronary artery calcium in the presence of metabolic risk factors than those without a family history.

Therefore overall evidence suggests that risk of atherosclerotic coronary vascular disease is increased among those with a family history of diabetes; suggesting that genetic factors associated with occurrence of familial diabetes may increase risk of CAD beyond the risk among people without family history of diabetes.

Life style of the patients was not an important risk factor as sedentary life style was noted in only 39% of patients and the majority were males. Similarly the nature of job also seems to be an un-important risk factor.
risk factor as the disease appears to be equally prevalent in persons employed at different jobs.

CONCLUSIONS

Our study shows that Family history, smoking, Hypertension, increased BMI, Increased abdominal girth, Dyslipidemia and Diabetes Mellitus are the main risk factors. There is no notable gender difference in frequency of various risk factors except in smoking which is almost exclusively noted in males. However there is very limited data available in the form of formal studies from our country. Considering the increasing incidence of the coronary heart disease in our society it is essential to assess and evaluate these risk factors prevalent at national level. It will enable us in formulating policies for promoting healthy lifestyles, frequent and early risk assessment and age specific preventive strategies.

REFERENCES

1. Ridker MP, Genest J, Lippy P. Risk factors for atherosclerotic heart disease. In: Braunwald E, Zipes DP, Libby P, editors. Heart Disease: A Textbook of Cardiovascular Medicine 6th ed. Philadelphia: W.B: Saunders Company; 2001:1010–1039.
2. Kuppuswamy V, Gupta S. Coronary heart disease in South Asians. Practitioner. 2003;247:181-182.
3. Perski A, Olsson G, Landou C, de Faire U, Theoreli T, Hamsten A. Minimum heart rate and coronary atherosclerosis: independent relations to global severity and rate of progression of angiographic lesions in men with myocardial infarction at a young age. Am Heart J. 1992;123(3):609-616.
4. 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;71:157-159.
5. Gordon T, Castelli WP, Hjortland MC, Kannel WB, Dawber TR. Predicting coronary heart disease in middle-aged and older persons: the Framingham study JAMA. 1977;238:497-499.
6. Toro K, Rausz E, Keller E. Sudden death due to ischemic heart disease among adolescents and young adults before and after the socio-economic changes in 1989 of Hungary. Arch Med Sadowej Kryminol. 2007;57(4):394-398.
7. Bhopal R, Fischbacher C, Vartiainen E. Predicted and observed cardiovascular disease in South Asians: application of risk. J Public Health (Oxf). 2005;27(1):93-100.
8. Shah SS, Noor L, Shah SH, Shahsawar, Din SU, Awan ZA, Hafizullah M. Myocardial infarction in young versus older adults: Clinical characteristics and angiographic features. J Ayub Med Coll Abbottabad. 2010;22(10):187-190.
9. Ahmad I, Shaftique Q. Myocardial infarction under age 40: risk factors and coronary arteriographic findings. Ann King Edward Med Coll. 2004;9:262–265.
10. Farmer JA, Gotto AM. Dyslipidemia and other risk factors for coronary artery disease. In: Braunwald E (ed), Heart Disease. A Textbook of Cardiovascular Medicine, 5th ed. Philadelphia: WB Saundar, 1997:1126-1160.
11. Gupta Sr, Gupta SK, Reddy KN, Moorthy JS, Abraham KA. Coronary artery disease in young Indians subjects. Indian Heart J. 1987;39:284-287.
12. Pais P, Pogue J, Gerstein H, Zachariah E, Savitha D, Jayprakash S, et al. Risk factors for acute myocardial infarction in Indians: a case control study. Lancet. 1996;348(9024):358-363.
13. Ma E, Iso H, Takahashi H, Yamagishi K, Tanigawa T. Age-Period-Cohort Analysis of Mortality due to Ischemic Heart Disease in Japan, 1955-2000. Circ J. 2008;72(6):966-972.
14. Yildirim N, Arat N, Dogan MS. Comparison of traditional risk factors, natural history and angiographic findings between coronary heart disease patients with age <40 and >or=40 years old. Anayolu Kardiyol Derg. 2007;7(2):124-127.
15. Wilson PW, Garrison RJ, Abbott RD. Factors associated with lipoprotein cholesterol levels. The Framingham Study. AHA J. 1983;3:273-281.
16. Rakugi H, Yu H, Kamitani A, Nakamura Y, Ohishi M, Kamide K, et al. Links between hypertension and myocardial infarction. Am Heart J. 1996;132(1):213-221.
17. McKiigue PM, Shah B, Marmot MG. Relation of central obesity and insulin resistance with high diabetes prevalence and cardiovascular risk in South Asians. Lancet. 1991;337(8738):382-386.
18. Ubbink JB, Vermaak WJH, Bennet JM, Becker PJ, van Staden DA, Bissbort S. The prevalence homocysteinemia and hypercholesterolemia in ageographically defined coronary heart disease. J Molecular Medicine. 1991;69(12):527-534.
19. Goel PK, Bharti BB, Pandey CM. A tertiary care hospital-based study of conventional risk factors including lipid profile in proven coronary artery disease. Indian Heart J. 2003;55(3):234-240.
20. Bhalodkar NC, Blum S, Rana T. Comparison of levels of large and small high density lipoprotein cholesterol in Asian Indian men compared with Caucasian men in the Framingham Offspring Study. AM J Cardiol. 2004;94(12):1561-1563.
21. 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;26:654-661.
22. Juonala M, Viikari AS, Rasanen L. Young Adults with family history of CAD have increased arterial vulnerability to metabolic risk factors: the cardiovascular risk in young Finns study. Arterioscler Thromb Vasc Biol. 2006;26(6):1376-1382.
23. Michos ED, Nasir K, Rumberger JA, Vasanreddy C, Braunstein JB, Budoff MJ, et al. Relation of family history of premature coronary heart disease and metabolic risk factors to risk of coronary arterial calcium in asymptomatic subjects. Am J Cardiol. 2005;95(6):655–657.
24. Park JW, Yun JE, Park T. Family history of diabetes and risk of atherosclerotic cardiovascular disease in Korean men and women. Atherosclerosis. 2008;197(1):224-231.