Effect of risk factors like age, gender, hypertension, diabetes, smoking, dyslipidemia on coronary artery disease in Karachiites with angiographical data of local population: Number, site, severity of coronary lesion

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Abstract: The aim of this study was to determine the effect of major risk factors like age, gender, hypertension, diabetes, smoking, dyslipidemia on coronary artery disease in Karachiites and highlighted the angiographic data of local population like number of vessels involvement, site and severity of coronary lesions. This was a cross sectional analytical prospective study which was carried out at Abbasi Shaheed Hospital Karachi from August 2004 – July 2014. We included five hundred (500) consecutive patients (188 female & 312 male) between 26-80 years old, who came for coronary angiography with suspecting ischemic heart disease clinically or otherwise proven by relevant tests like ETT, ECHO, and Thallium stress test. Post PCI and CABG patients were excluded from study. During this study variables like age, gender, hypertension, diabetes, smoking and dyslipidemia were taken into account in relation to coronary artery disease in Karachiites. In addition we also assorted some important findings of coronary angiography like: number of vessels involved, site and severity lesions in our population and compared them with existing literature. Our study revealed that in our local population not only old age and male gender are potential threat for an early coronary artery disease but other variables like hypertension, diabetes, smoking, and dyslipidemia are also playing important role in coronary artery disease. It is also concluded that our population is more prone to multiple vessels involvement with almost involvement of LAD in majority of population.

Keywords: Coronary artery disease, coronary angiography, age, gender, hypertension, diabetes, smoking, dyslipidemia, number, site, severity of coronary vessel, Karachiites.

INTRODUCTION

Cardiovascular disease is the leading cause of death both in men and women of the United States and worldwide (WHO, 2009) approximating 40% of all deaths. According to the Centers for Disease Control and Prevention (CDC) approximately 61 million people in the United States are suffering from cardiovascular disease (Am Heart Assoc. Circu., 2011). The established major risk factors that predispose to CAD/MI include hyperlipidemia, dyslipidaemia, systemic hypertension, cigarette smoking, diabetes mellitus, sedentary lifestyle, and obesity. Only five of these risk factors have been shown to account for about 89.9% of first MI in Africans (Nation Daily, 2010). In Pakistan and other third world countries, the situation is even worse. There is rapid rise in the number of patients with ischemic heart disease and deaths. The cardiac arrest alone contributes to 25% of death secondary to ischemic heart diseases in this country. The situation has become really alarming with diagnosis of ischemic heart disease at quite a young age and even in childhood. Although no accurate data is yet available, the burden of cardiovascular diseases is expected to be highest in view of behavioral and lifestyle changes in Pakistan[3]. There is limited evidence for population screening, but prevention, with a healthy life style including diet control, exercise, weight reduction, cessation of smoking, strict control of diabetes, lowering cholesterol and high blood pressure will definitely help to decrease the risk of complications (Kumar, 1994).

Investigation is very important for discovering ischemic heart disease in its early stages and is crucial for patients because it can prevent a lethal heart attack. One of the most common methods of diagnosis is the electrocardiography (ECG). Nevertheless ECG isn't always sufficient in making the diagnosis of ischemic heart disease. There are the patients who present with typical symptoms and normal ECG. In such patients an exercise or Treadmill Test is often advised to assess the severity of the disease and functional capacity. Treadmill test is also being recommended in high-risk patients

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especially older patients irrespective of their symptoms (Sigal *et al*. 2004).

Echocardiography is done to assess cardiac chamber sizes, valvular and ventricular function. It can be done as conventional transthoracic or stress Echo. It helps in assessing wall motion abnormalities in respect of hypokinesia, hyperkinesias, akinesia or dyskinesia (Anderson, 2004). In the ischemic heart disease myocardial perfusion scanning is another important tool used for an early diagnosis and to look for reversibility of myocardium, which helps in assessing the degree of stenosis of coronary vessels (Anagnostopoulos *et al*., 2001). However, if the tests or risk factors predict that an individual is likely to have ischemic heart disease then physician may recommend a coronary angiography. It provides accurate information regarding anatomy, dimensions of the vessels, site and type of stenosed lesion (measurement of the dimensions and pressure gradient) and also helps in further course of management (Christopher *et al*. 1996).

MATERIALS AND METHODS

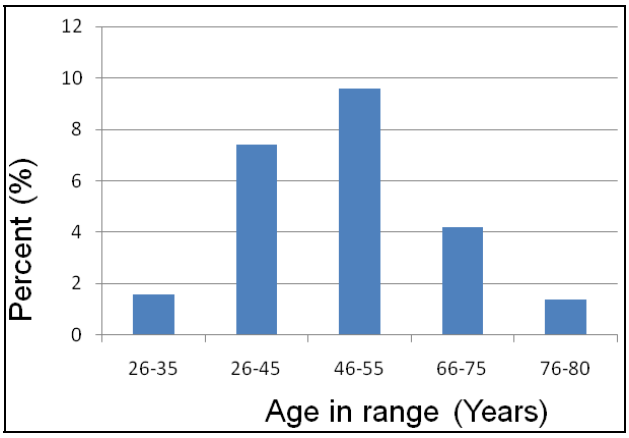
Five hundred consecutive patients (188 female & 312 male) between 26-85 years old belonging to any socio-economical status were included who came for coronary angiography at Abbasi Shaheed Hospital Karachi from August to July 2014 with suspecting ischemic heart disease clinically or otherwise proven by relevant tests like ETT, ECHO, and Thallium stress test. We excluded patients having history of angioplasty (PCI) and coronary artery by-pass grafting (CABG). Detail histories with examination were carried out and all patients under went coronary angiography according to gold standard procedure including written and informed consents. Their cine films were interpreted independently by a team of cardiologists to avoid biased opinion.

RESULTS

We included five hundred (500) consecutive patients of both gender belonging to different socio-economical status who came for coronary angiography having ischemic heart disease clinically or otherwise proven by non-invasive cardiac diagnostic tests like ETT, ECHO, and Thallium stress test. During this study different variable of patients like age, gender, hypertension, diabetes mellitus, dyslipidemia, smoking and there relation to number of vessels involvement, site and severity of lesions were taken into account. The data of these patients were also statistically analyzed. Following are the variables that were found after analysis of data and all were shown in tables.

Age

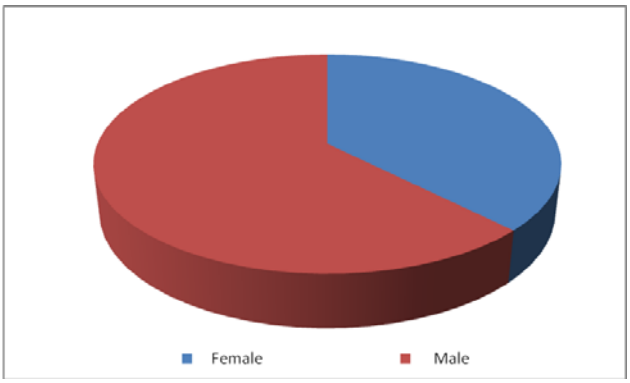
The descriptive statistic shows that the minimum age limit was 26 years and maximum age limit was 80 years with a mean age 54.11 years and standard deviation 11.57 as illustrated in bar graph below.



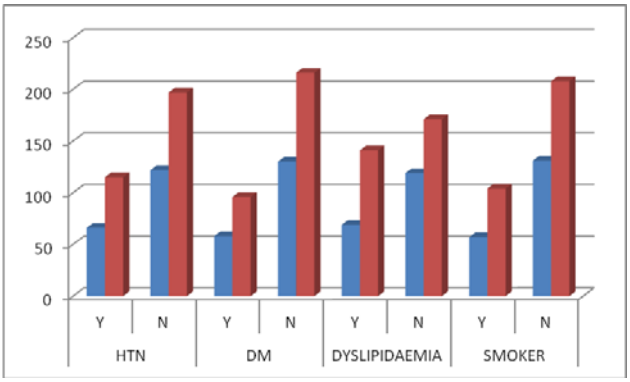
Graph 1: Age group of study population divded according to decade.

Gender

Descriptive statistic shows that out of 500 patients, 188 were females and 312 were males as shown in pie graph 2.



Graph 2: Male to female ratio in study groups.

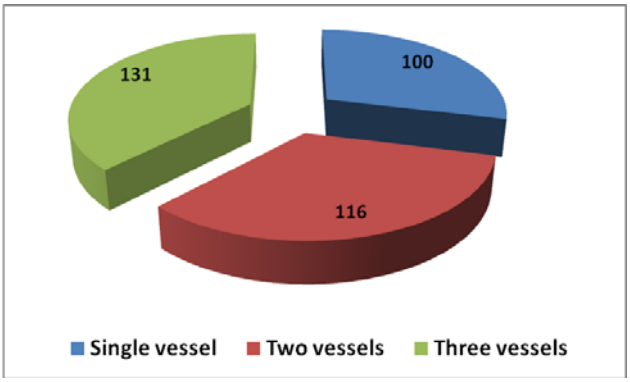


Graph 3: Study groups with disease and without disease.

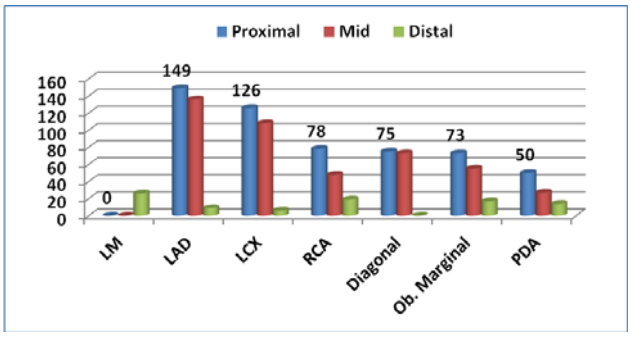
Hypertension

The descriptive static shows that the valid percent of hypertensive patients (systolic blood pressure ≥140mm of Hg and diastolic ≥90mm of Hg) is 36.2% with frequency

of 181 and valid percent of normotensive patients is 63.8% with frequency of 319 out of 500 of valid patients as mentioned in table 1 below:



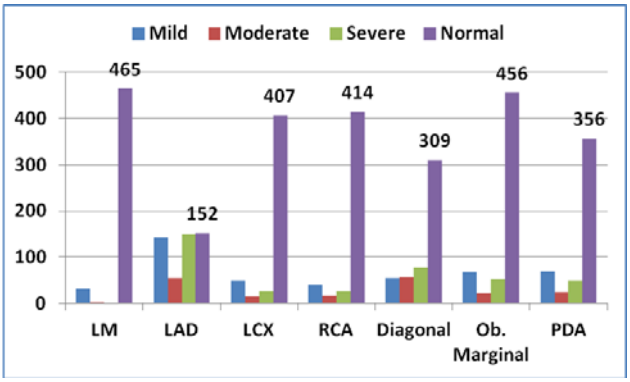
Graph 4: Study groups with single and multi-vessels disease.



Graph 5: Study groups divided according to site of disease.

Diabetes

The descriptive static shows that the valid percent of patients with diabetes are 30.8% with frequency of 154 and valid percent of non- diabetes patients are 69.2% with frequency of 346 out of 500 of valid patients as mentioned in table 2 below:



Graph 6: Study groups divided according to severity of disease

Smoking

The descriptive static shows that the valid percent of patients who smoked is 32% with frequency of 160 and valid percent of non-smoker is 68% with frequency of 340 out of 500 of valid patients as mentioned in table 3 below:

Table 1: Hypertensive and normotensive study groups

Frequency of Hypertensive versus Normotensive patients		
No. of Patients	Frequency	Percent
Hypertensive	181	36.2
Normotensive	319	63.8
Total	500	100

Table 2: Diabetic and non-diabetic study groups

Frequency of Diabetic versus Non- diabetic patients		
No. of Patients	Frequency	Percent
Diabetes	154	30.8
Non-Diabetes	346	69.2
Total	500	100

Table 3: Smoker and non-smoker study groups

Frequency of smoker versus Non- smoker patients		
No. of Patients	Frequency	Percent
Smoker	160	32
Non-smoker	340	68
Total	500	100

Table 4: Dyslipidaemia and normal lipid profile groups

Frequency of patients with Abnormal lipid profile versus Normal lipid profile		
No. of Patients	Frequency	Percent
Dyslipidaemia	210	42
Non-Dyslipidaemia	290	58
Total	500	100

Dyslipidaemia

The descriptive static shows that the valid percent of dyslipidaemia patients are 42% with frequency of 210 and valid percent of male patients is 58% with frequency of 290 out of 500 of valid patients as mentioned in table 4 below:

Combined risk factors divided according to having coronary artery disease and those free from disease

All patients' data having coronary artery disease and those free from disease according to effect of different Comorbids divided was given in table 5 and also shown in bar graph 3 below:

Number of vessels

The descriptive static shows that the valid percent of patients having single vessel disease (SVD), two vessels disease (2VD) and three vessel disease (3VD) are 20%, 23.2% and 26.2% respectively. Rest of the 30.6% patients has normal coronaries out of 500 of valid patients, see graph 4 below:

Table 5: All co-morbids patients groups

Hypertension		Diabetes		Dyslipidaemia		Smoker	
Having Disease	Disease Free	Having Disease	Disease Free	Having Disease	Disease Free	Having Disease	Disease Free
66	122	58	130	69	119	57	131
115	197	96	216	141	171	104	208

Site of lesion

The site of lesion of coronary artery disease in our study reveals that there was no fixed site. However, we found no proximal lesion in left main, but distal lesions of 5.2% in left main and proximal lesions of 29.8% in left anterior descending artery (LAD), 25.2% in left circumflex artery (LCX), 15.6% in right coronary artery (RCA), 10% in posterior descending artery (PDA). The larger branches like diagonal (D) of LAD and obtuse marginal (OM) of LCX showed 15% and 14.6% proximal lesions respectively. There was no mid vessels lesion in LM, however other vessels involved at mid region. These middle lesions are i.e.; 27.2% in LAD, 21.6% in LCX, 9.6% in RCA, 14.6% in diagonal and 11% in OM, 5.4% in PDA. The distal lesions in different coronary vessels which were observed as followed in LAD 1.8%, LCX 1.2%, RCA 3.8%, OM 3.4% and in large PDA 2.8% while there was no distal found in diagonal branch, see graph 5 below:

Severity of lesion

The severity of lesion is also important because a lesion needs not to be obstructive to become thrombogenic or all obstructive lesions have no thrombogenic potentials. The cause of an infarct may thus be ruptured of a non-obstructive plaque leading to occlusive thrombus formation. In our study we found different variety of severity of CAD; mild disease in LM is about 6.4% and only one had severe disease. In LAD lesions, mostly were mild to moderate disease while 30% had severe disease. In LCX mostly were normal i.e. 81% and in diseased LCX only 5.4% had severe lesion. In RCA it was observed that mostly vessels were normal i.e. 82.6% and only 5.4% had severe disease, see graph 6 below:

DISCUSSION

In our study mean *age* for coronary artery disease were 54±10 years (see bar graph 1) while literature review showed mean age is 60±5 years (Muhammad *et al*., 2006). The reason for younger age limit in our population is likely secondary to genetic factors, life style and lack of awareness (Michael *et al*. 1999). In addition increase in diabetes mellitus is associated with an increased risk of cardiovascular death and a higher incidence of cardiovascular diseases including coronary artery disease (Chiha *et al*., 2012). Other established major risk factors that predispose to CAD/MI include hyperlipidemia/ dyslipidaemia, systemic hypertension, cigarette smoking and obesity (Essien *et al*. 2014). Our study also showed the moderate relevance between *sex* and coronary artery disease using Logistic regression (R) odd ratio (0.25) and showing high significant (p-value=0.001 using Chi Square test) i.e. female patient's was at low risk in compare with male patient's (graph 2). It resembles with literature review, which revealed that female patients have lower mean value for coronary artery disease due to estrogen protective effects. It is well known that estrogen increases the vasodilatation and inhibits the response of blood vessels to injury and the development of atherosclerosis (Jafar *et al*., 2005). However, after the menopause, the incidence of cardiovascular disease in women is more closely approximates to men. Our study also showed the strong relevance between *hypertension* and coronary artery disease using Logistic regression (R) odd ratio (0.49) and showing highly significant ($p < 0.001$ using Chi Square test, see graph 3). Study by Jafar TH *et al* on prevalence of hypertension found 26.9% people ≥ 40 years of age suffer from CAD in Pakistan. The reason for high prevalence of this risk factor is likely due to lack of awareness of associated complications from risk factor secondary to socioeconomic status (Iqbal *et al*., 2004). This study also showed the moderate relevance between *diabetic* and coronary artery disease using Logistic regression (R) odd ratio (0.25) and showing high significant (p-value = 0.001 using Chi Square test, see graph 3). Previous studies also showed that the incidence of coronary heart disease was high in diabetic as compared to non-diabetic (Simons *et al*., 1981). Our study also showed the strong relevance between *smoker* and coronary artery disease using Logistic regression (R) odd ratio (0.86) and showing high significant (p-value=0.01 using Chi Square test, see graph 3) i.e. smokers are more prone to coronary artery disease than non-smoker. Consequently, smokers have a higher risk of cardiovascular disease than nonsmokers (Zieske *et al*. 2005). It is well-recognized fact that among individuals with advanced lesions (Grade 4 or 5); smokers had a greater prevalence of Grade 5 lesions than non-smokers because smoking accelerates the transition from Grade 4 to Grade 5 lesions by promoting thrombosis and accretion on the intimal surface of the plaque (Zieske *et al*., 2005). Our study also showed the moderate relevance between *dyslipidemia* and coronary artery disease using Logistic regression (R) odd ratio (0.65) and showing highly significant (p-value=<0.001 using Chi Square test, see graph 3) which indicated that dyslipidemia was also poor prognostic factor for coronary artery disease. It has been proven by literature survey that dyslipidemia will increase the risk for coronary heart disease events up to threefold.

This is an important risk factor for the initiation and progression of atherosclerosis and is strongly associated with cardiovascular events[14]. In our study we observed that patients with co-morbids were more induced to *multiple vessels disease* as compare to single vessel. Multi vessels coronary artery disease involvement was observed in 49.4% while single vessel involvement was seen in 20 %. Out of 500-study population, 153 (30.6%) patients had normal coronary arteries (see graph 4). Literature is also evident of the findings that left main or three-vessel coronary disease occurred in more than 50% of middle-aged men and older women with definite angina and in more than 50% of men who had probable angina and were older than 60 years of age[16]. Beside that patients with multi-vessels disease had lower left ventricular ejection fractions as compare with patients having single vessel disease (Chaitman *et al*., 1981). The *site of lesion* of CAD in our study showed that they had no fixed site. However, we found no proximal lesion in left main, but distal lesions of 5.2% in left main and proximal lesions of 29.8% in LAD, 25.2% in LCX, 15.6% in RCA, 10% in PDA. The larger branches like diagonal of LAD and obtuse marginal of LCX showed 15% and 14.6% proximal lesions respectively. There was no mid vessels lesion in LM, however other vessels involved at mid region. These middle lesions are i.e.; 27.2% in LAD, 21.6% in LCX, 9.6% in RCA, 14.6% in diagonal and 11% in OM, 5.4% in PDA. The distal lesions in different coronary vessels which were observed as followed in LAD 1.8%, LCX 1.2%, RCA 3.8%, OM 3.4% and in large PDA 2.8% while there was no distal found in diagonal branch. Our findings when correlates with literature suggested that LAD was the most common vessels involved although were less frequently diseased. The severity of lesion is also important because a lesion needs not to be obstructive to become thrombogenic or all obstructive lesions have no thrombogenic potentials. The cause of an infarct may thus be ruptured of a non-obstructive plaque leading to occlusive thrombus formation. In our study we found different variety of *severity of CAD*; mild disease in LM is about 6.4% and only one had severe disease. In LAD lesions, mostly were mild to moderate disease while 30% had severe disease. In LCX mostly were normal i.e. 81% and in diseased LCX only 5.4% had severe lesion. In RCA it was observed that mostly vessels were normal i.e. 82.6% and only 5.4% had severe disease (graph 6). Literature is also evident of same findings that most frequently coronary lesions are mild or moderate one that leading to heart attack. Similar finding in previous study showed that sudden rupture of a previously hemodynamically insignificant lesion (stenosis with an angiographic severity of ≤70%) would explain why acute myocardial infarction and sudden cardiac death frequently occur in patients without prior symptoms of coronary artery disease (Howard & Herrmann, 2011). On other hand 20% of all severe stenotic lesions (lesion with angiographic stenosis severities between 71% and 90%) did not induce reversible myocardial ischemia but sometime 35% stenosed vessels may become functionally significant (Paul *et al*., 2002).

CONCLUSION

Our study revealed that not only elder age and male gender are potential threat for an early coronary artery disease but other variables like hypertension, diabetes, smoking, dyslipidemia are also important risk factors. In addition it is also found that our population is more prone to multiple vessels involvement with more proximal and mid lesions in LAD as compared to other major vessels versus more distal lesions RCA territory. It is also reported that mostly involvement of lesion in LAD with high percentage of severe lesion while LCX & RCA has low and equal percentage of severe lesion. Prospective longitudinal follow-up studies are required to asses other true risk factors like obesity, hip-waist ratio, hormonal disturbances in females, CRP, homocystien level, etc. for ischemic heart disease (IHD) and coronary vessel mortality (CVD).

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