

# The pattern of coronary artery diseases as diagnosed by coronary angiography and the outcome of Percutaneous Coronary Intervention (PCI) in Ethiopia

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## Abstract

**Background:** No countrywide study has been done on cardiovascular disease (CVD) in Ethiopia. Nonetheless, some hospital based studies and a few community based researches have shown CVD as one of the causes of morbidity and mortality.

**Methods:** This retrospective coronary angiographic study was conducted at Addis Cardiac Hospital, Addis Ababa, Ethiopia, with the objective of determining the pattern of coronary artery disease (CAD) by coronary angiography. All patients for whom coronary angiography and PCI was done from May 1, 2007 to December 30, 2011 were considered for the study.

**Result:** Diagnostic coronary angiography was done to 300 patients, of which, 249 patients (83%) were males and 51 patients (17%) were females with the age range of 29 to 87 years. The median age was 56 years with mean ages of  $56.3 \pm 12.1$  and  $56 \pm 11.3$  for males and females respectively, the most frequent age stratum being 50 to 59 years. Acute coronary syndrome was the clinical diagnosis in 161 (53.7 %) of patients, of which 100 patients (33.3% of the total) had ST segment elevation myocardial infarction (STEMI). With catheterization, 227 (75.7%) patients had evidence of CAD, of which, 92 (40.5%) patients had multivessel disease. Among the 193 patients with significant CAD, PCI was done for 126 (65.3%) patients which resulted in TIMI III (thrombolysis in myocardial infarction flow grade III) in 116 patients (92.1%).

**Conclusion:** Pending confirmation with prospective studies, CAD is perhaps aggressive in Ethiopia with serious consequences and PCI without on-site cardiac surgery has been proven safe. [*Ethiop. J. Health Dev.* 2014;28(1):11-16]

## Introduction

Worldwide, CVD is estimated to be the leading cause of death and loss of disability-adjusted life years (1). Although age-adjusted cardiovascular death rates have declined in several developed countries over the past decades, the rate of CAD has raised greatly in low income and middle income countries (1, 2), with about 80% of the burden now occurring in these countries.

In sub-Saharan Africa, the prevalence of communicable diseases still exceeds those of chronic diseases, (3). Plagued by HIV/AIDS and other communicable diseases, as well as an emerging epidemic of CVD, this region and many low-income countries are facing a “double burden” of disease that is stretching the already limited resources. In these developing countries with a high proportion of citizens younger than 65, the onset of CVD occurs among ever-younger people, posing a threat to economic and social development (3). The rates of death and disability attributable to CVD in the labor force will be much greater than in western nations, now or even in the past.

No countrywide study has been done on CVD in Ethiopia. However, some hospital based studies and a few community based researches have shown CVD as an important cause of morbidity and mortality. Studies done in the late 1960s and 1970s showed CVD to account for 4-13% of medical admissions to hospitals in Addis Ababa (4-6). During the period from September 1975 to

August 1979, there were a total of 5667 patients admitted to the medical wards of the Black Lion Hospital, Addis Ababa, of whom 381 (6.7%) admissions were due to CVD (7), whereas recent studies indicated the increasing frequency of CVD in residents of Addis Ababa. In a report released in 2001, in an autopsy study done on bodies brought by police to the Medico-legal Department of Menilik II Memorial Hospital, after sudden death, CAD accounted for 70% of those who died due to cardiac causes (8). In another retrospective, clinical analysis, acute myocardial infarction (MI) accounted for 8.8 % of the admissions to the Medical Intensive Care Unit of Black Lion Hospital making it the third commonest cause of admission after severe malaria and diabetic ketoacidosis (9).

This coronary angiographic study was thus undertaken to assess the prevalence of CAD at Addis Cardiac Hospital with the objective of determining its pattern as diagnosed by angiography, a gold standard investigation step. Clinical characteristics and coronary risk factors were assessed to verify the particularities seen among Ethiopian patients in previous studies which were limited to clinical analysis.

## Methods

Addis Cardiac Hospital was founded in May 2007 with 20 bed capacity and a cardiac catheterization laboratory for the first time in Ethiopia. It was established with the main purpose of upgrading the level of cardiac care in the

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country to curtail the rigors of referral abroad and to reduce the amount of foreign currency loss in the process. Selection of patients for PCI requires careful consideration of the extent of symptoms of ischemic myocardium, the response to medical therapy, the likelihood of fatal or serious morbid outcome in the event of abrupt vessel closure, expected incidence of restenosis and suitability of the patient for coronary bypass grafting (CABG). With regards to UA/NSTEMI, initial invasive strategy is followed for those with hemodynamic instability, electrical instability, refractory angina or those initially stabilized with medical treatment but remaining at elevated risk for clinical events.

All consecutive patients that have undergone coronary angiography from May 1, 2007 to December 30, 2011 were considered in the study. Epi-info software program was used to analyze the data. Data are presented in tables and graphs, summarized using median, mean and standard deviation as appropriate. Chi square and t-test were applied to test statistical significance and P value less than 0.05 was considered significant.

### Results

From May 1, 2007 to December 30, 2011 diagnostic coronary angiography was done for 300 patients, of whom 249 patients (83%) were males and 51 patients (17%) were females with the age range of 29 to 87 years. The median age was 56 years with similar mean ages of  $56.3 \pm 12.1$  and  $56.3 \pm 11.3$  for males and females respectively, the most frequent age stratum being 50 to 59 years (Table-1). Of the 300 patients, 238 (75.7%) were from Addis Ababa, while 59 patients (19%) came from outside of Addis Ababa.

Table 1: **Socio-demographic characteristics of study subjects**

Characteristics	Number	Percent
<b>Sex</b>		
Male	249	83
Female	51	17
<b>Mean age</b>		
Male	Mean±SD	
	56.3±12.1	
Female	56.0±11.3	
Overall	56.3±11.8	
<b>Address</b>		
Addis Ababa	238	79.3
Out of Addis	62	20.7
Total	300	100

The most frequent clinical diagnosis in those who were subjected to coronary angiography was acute coronary syndrome which was found in 161 patients (53.7%), of which 100 patients (33.3% of the total) had STEMI, 61 patients (20.3% of the total) had UA/NSTEMI and only 57 patients (19% of the total) had stable angina pectoris (Fig- 1). According to the pre-angiographic evaluation, the two most frequent risk factors of CAD were hypertension and dyslipidemia occurring in 61.2% and 63 % of patients respectively followed by diabetes which was found in 124 (41.4%) of patients and 91.3% of the patients were diagnosed to have at least one risk factor (fig-2). Out of the 98 patients with 3 or more risk factors, 73 patients (74.5%) had abnormal coronary arteries while only 4 patients without any of the standard risk factors had evidence of CAD. Thirty six patients (12%) had previous MI, while only 9 patients (3%) had previous stroke.

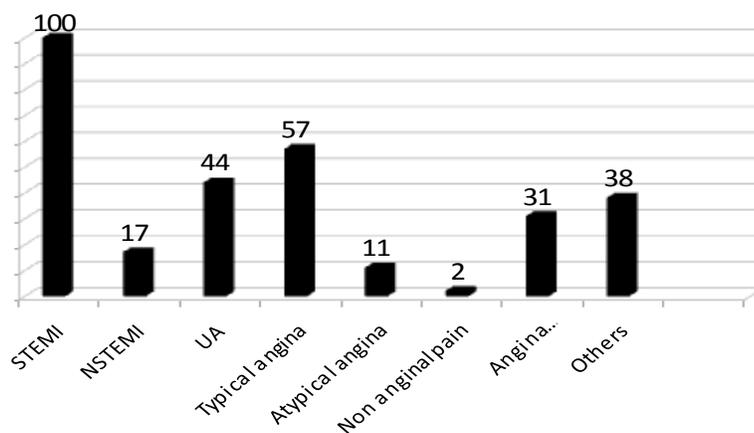


Figure 1: **Clinical diagnosis in patients who have undergone coronary angiography**

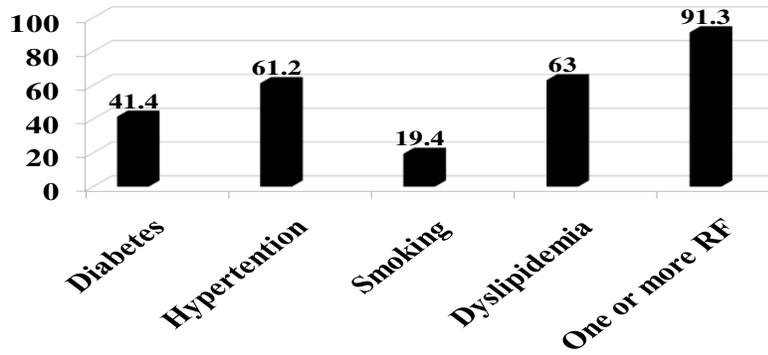


Figure 2: Frequency of risk factors in patients who have undergone coronary angiography

Among the 300 patients who underwent coronary angiography 227 patients (75.7%) had evidence of CAD, of which 193 patients (85%) had significant disease (more than 50% stenosis in the left main coronary artery or more that 70% stenosis at other coronary beds) while 34 patients (15%) were diagnosed to have no significant

CAD. Ninety eight patients (43.2%) of those with evidence of CAD on coronary angiography had single vessel disease, 92 patients (40.5%) had multivessel disease whereas only 3 patients (1.3%) were diagnosed to have left main coronary disease (fig.3).

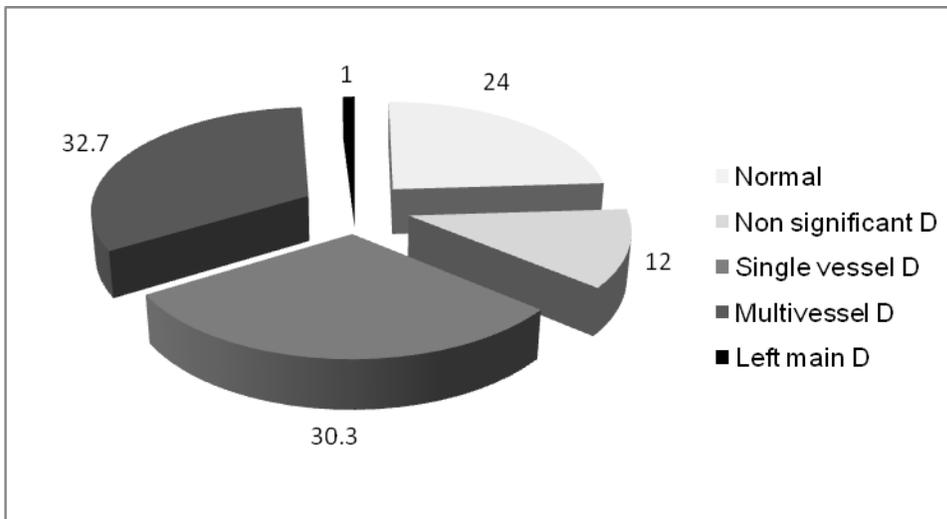


Figure 3: Extent of coronary artery involvement among patients on whom coronary angiography was done

Frequency of coronary angiogram positivity progressively decreased from STEMI patients to more chronic presentations. Ninety four of the 100 patients with STEMI had abnormal coronary arteries, while only 5 patients with atypical angina (45.5%) and 14 patients with angina equivalent (35.2%) had abnormal coronary

arteries (table-2). Among the 100 patients with STEMI, 52 patients had single vessel disease and only 18 patients had three vessel disease. On the contrary, in typical angina the frequency of single vessel disease was 10.5% while 38.6% had angiographic evidence of three vessel disease (Fig 4).

Table 2: Coronary angiographic findings in different clinical diagnosis

	Normal (%)	Abnormal (%)	Total
STEMI	6 (6)	94 (94)	100
NSTEMI	2 (11.8)	15 (88.2)	17
UA	8 (18.2)	36 (81.8)	44
Typical angina	16 (28.1)	41 (71.9)	57
Atypical angina	6 (54.5)	5 (45.5)	11
Non anginal pain	2		2
Angina equivalent	17 (54.8)	14 (35.2)	31
Others	16 (43.2)	21 (56.8)	38
Total	73		300

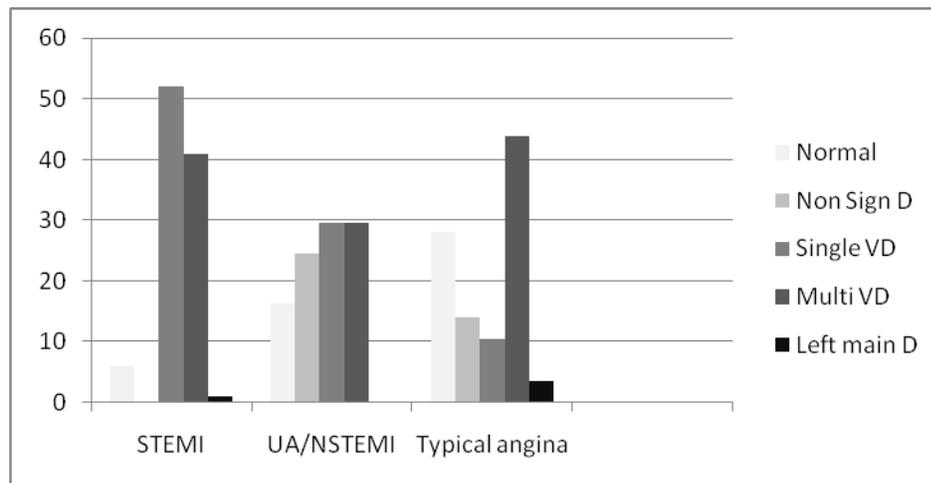


Figure 4: Coronary artery disease burden among patients with different clinical diagnosis

Females accounted for 35% of those with normal coronaries, while only 16.3% of those with CAD were females. Among 227 patients whose coronary angiography was positive for CAD, 104 patients (45.7%) had diabetes and 217 patients (94.3%) had at least one established risk factor while the presence of at least one risk factor was 83.1% in those with normal angiograms, the difference was statistically significant ( $P < 0.01$ ). In the age group of less than 45 years, CAD was diagnosed in 58.5% of patients whereas 79.6% of those with age 45 years or more had evidence of CAD.

Among the 193 patients with significant disease PCI was done for 126 (65.3%) patients of which in 123 patients (97.6%) stents were deployed. Out of these, 95 (77.2%) received bare-metal stents and 28 (22.7%) were treated with drug-eluting stents. In 67 patients (34.7%) CABG was recommended. TIMI-III flow was achieved in 116 patients (92.1%) of those treated with PCI. Two patients had abrupt vessel occlusion in the course of procedures; one was following a successful PCI with stenting whereas the other, a 70-year-old diabetic with chronic kidney disease (CKD), died 24 hours later. There was one stroke, 2 major bleeding episodes requiring transfusion and 3 major arrhythmias which were managed with immediate electrical cardioversion. There were 3 deaths, of which 1 was because of the abrupt vessel occlusion stated above, 1 due to suspected retroperitoneal bleeding after a femoral procedure on top of a progressively worsening heart failure with preexisting significant left ventricular dysfunction and the remaining was due to deteriorating cardiac status following PCI with stenting.

### Discussion

CHD mortality rate has progressively declined over the past four decades in the economically developed world. However, it remains responsible for about one-third of all deaths in individuals over the age of 35 (10, 11). In a 2009 report that used National Health and Nutrition Examination Survey (NHANES) data, MI prevalence was compared by sex in middle-aged individuals (35 to

54 years) during the 1988 to 1994 and 1999 to 2004 time periods. There were trends toward a decrease in men and an increase in women (12). Autopsy data have also documented a reduced prevalence of anatomic CHD over time in the general population (13).

In an analysis of 3832 autopsies performed on United States military personnel who died of combat or unintentional injuries between October 2001 and August 2011, the prevalence of CHD was 8.5 percent (14). This represents a marked decline in prevalence of autopsy-documented CHD compared with the rates seen during the Korean War in the 1950s (77%) and the Vietnam War in the 1960s (45%) (14).

There is no information on the incidence or prevalence of coronary artery disease in Ethiopia. The existing information is limited to hospital admission analysis and some group surveys (4, 5, 7, 9, 15-17). Among the studies, those in the sixties showed IHD as rare diagnosis (4, 5, 15), while studies in the eighties and nineties began to show increasing frequency of IHD (9, 17). In an autopsy study reported in 2001 on sudden deaths brought by police to the Medico-legal Department of Menilik II Memorial Hospital in Addis Ababa, out of the 63 hearts showing structural changes that could explain the deaths, 44 (66%) were due to CAD (8). In this study CAD has been shown to be an important health problem in the country, which was once assumed to be a rarity.

In the African setting where accessibility is a major constraint hospital based studies have serious limitations to show the true picture of a disease. Besides, the number of patients who are able to undergo coronary angiography/PCI is further limited by logistical issues. Except for few nongovernmental institutions, there isn't a wider insurance coverage in Ethiopia that includes reimbursement for coronary angiography and PCI. This has restricted the procedure to a meager segment of perhaps the vast patient population, those who are able to pay individually, in the present study.

In our study, among patients with clinical indications for coronary angiography, 300 patients had the opportunity to undergo the procedure over 4 a year period. The mean age of patients was at least 10 years younger than their counterparts in the developed world (18, 19). This is similar to a previous clinical study (without coronary angiography) on Ethiopian patients (9). Considerable number of patients came from outside of the capital, Addis Ababa, indicating the necessity of well designed prevalence study across the country to disprove the old thought that assumes CAD a rarity. Hypertension and dyslipidemia were the two most frequent risk factors encountered and the majority of cases had at least one standard risk factor which is in agreement with other studies (9, 20). Smoking was the least frequent risk factor identified among patients suspected to have IHD similar to previous studies done on MI and stroke (10, 21). The pattern was nearly the same when those with angiograms positive for CAD were separately analyzed showing restriction of the procedure to those who require it.

When compared to the number of cases of typical angina, the most frequent clinical consideration before coronary angiography has been acute coronary syndrome which is much higher than what was documented elsewhere (22). This indicates that patients commit to undergo the procedure in more serious clinical conditions. A third of the patients had STEMI contrary to what was documented in developed countries where there has been a relative increase in NSTEMI in relation to STEMI with time (23, 24). It appears that the low mean age does contribute to higher frequency of STEMI in Ethiopian patients. An additional factor for this apparently higher frequency of STEMI may be the fact that patients commit to coronary angiography and PCI in more serious and disturbing condition like STEMI than NSTEMI or other less typical manifestations.

The frequency of positive angiograms is higher than previous records (25). Great majority of patients in acute coronary syndrome had positive angiograms while angiographic positivity drastically dropped as presentation turns atypical, similar to what has been described for patients in the 1970s in Europe and America (26).

The proportion of patients who received bare metal stents is lower than what has been recorded in some centers in the west (27), a reflection of the limited application of drug eluting stents due to economic reasons and unreliability of our patients in maintaining long-term dual antiplatelet therapy. Although there are no documents on compliance of dual antiplatelet therapy in Ethiopia, in our daily practice discontinuation of important medications is a frequent encounter in which case the disadvantage of a drug eluting stent may outweigh its benefit. When taken together, the proportion of patients which were recommended to undergo CABG and those with diffuse disease that have remained with medical treatment is higher than reports elsewhere (28). The higher frequency

multivessel disease in Ethiopian patients with stable angina and other chronic manifestations might be an indication of delayed presentation. Although the absence of documented vital statistics across the country indicates unreliability of the registered ages, this study may still indicate a higher disease burden in the younger patient population.

Coinciding with the technological advances and improved pharmacology the need for emergency CABG during PCI drastically dropped over the last decades (29). This opened the venue for studies that showed survival benefit of standalone PCI (without on-site cardiac surgery) compared to medical treatment (30). In view of the capital intensive nature of cardiac surgery and the time and recourse needed to train a cardiac surgical team, provision of safe PCI in resource limited places is a commendable step in the treatment of CAD.

The death rate recorded in our study is generally in conformity with findings at other centers (30). The suspected case of retroperitoneal bleeding, with moderate to severe left ventricular dysfunction before the procedure, developed clinical signs of bleeding together with worsening heart failure 12 after the procedure. The dominant manifestation of heart failure without shock is against retroperitoneal bleeding as a sole cause of death in this patient. Even if the provision exists, condition of the patient was a poor surgical risk which is a frequent encounter once PCI is complicated. Therefore, the existing low complication rate of coronary angiography and PCI in at Addis Cardiac Hospital, when compared to the meager number of patients salvaged by surgery in the event of complicated PCI, is a very rewarding finding.

#### **Conclusion:**

Pending confirmation by prospective studies assisted by more evident documentation of age the following conclusions can be drawn:

1. Coronary artery disease is aggressive in Ethiopia with serious consequences, evidenced by its development early in life and more extensive involvement of the coronary vasculature.
2. Coronary intervention without on-site cardiac surgery has been proven safe.

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