

Retraction Announcement

The following manuscript has been retracted from our November - December, 2014 issue by the authors as they wish to add some more data. - **Editor**

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Original Article

Non obstructive coronary artery disease in patients admitted for elective coronary angiography

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ABSTRACT

Objective: To determine the frequency of non-obstructive coronary artery disease in patients admitted electively without known heart disease at a local tertiary care cardiac hospital.

Methods: During the period May 1st 2012 to April 30th 2013, we have collected data from TABBA Heart Institute (THI) Cath Registry, for patients who came for elective coronary angiography without known heart disease at TABBA Heart Institute a local tertiary cardiac care centre. The patient demographic characteristics, risk factors, symptoms and the result of noninvasive testing were correlated with the presence of non obstructive and obstructive coronary artery disease. Data was analyzed through SPSS version 17 and chi square test was applied for significance of data.

Results: Out of 1478 cases examined, 368 cases were enrolled in this study that fulfilled the inclusion criteria. Out of these, 273 (74.2%) were obstructive CAD cases whereas 95(25.8%) were found to have non-obstructive coronary angiogram. In these 95 cases, 67 cases had gone for cath without non-invasive testing i.e. 18.2%.

Conclusion: Although only 18.2% cases had gone for unnecessary angiogram procedure, it could be easily avoided just by following the American Heart Association (AHA) guidelines.

KEY WORDS: Elective coronary angiography, non obstructive coronary artery disease, AHA guidelines.

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INTRODUCTION

Over the last decade, rapid advances have been made in diagnosis of coronary artery disease (CAD), especially among stable patients. These advances have been incorporated by AHA/ACCF in guidelines, to determine CAD among stable patients.¹ Observation in case of low risk patients, non-invasive stress testing in case of intermediate risk and direct referral for cardiac catheterization in high risk patients are the summarized recommendation by the AHA/ACCF for stable patients, with an ultimate goal of appropriate resource utilization.²

Cardiovascular disease has become one of the leading cause of mortality in Pakistan.³ This annual increasing trend has in turn promoted the rise of Cardiac Catheterization laboratories being opened up all over the country in both private and public sectors. Although cardiac catheterization is

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considered by some as the gold standard for CAD diagnosis, there is a concern that it is being used excessively in stable CAD patients.

The primary aim of our study was to determine the frequency of non obstructive coronary artery disease in patients admitted without known heart disease and to evaluate clinical risk factors, presenting symptoms, results of non-invasive testing among patients found to have non-obstructive and obstructive coronary artery disease.

METHODS

We conducted a retrospective study at the TABBA Heart Institute (THI), a tertiary Cardiac Care Hospital in Karachi, Pakistan using the THI Cath Registry. The THI Cath Registry is modeled in line with National Cardiovascular Data Registry (NCDR). The NCDR registry is sponsored by the American College of Cardiology and the Society for Cardiovascular Angiography and Intervention.⁴ Similar data variables or definitions were used in our study as well.

All patients in THI Cath Registry, who underwent diagnostic cardiac catheterization during the period 1st May 2012 to 30th April 2013, were initially screened (Fig.1). Inclusion criteria for our study included only those patients who had no prior heart disease. We excluded 220 patients having prior myocardial infarction, 122 with a history of prior PCI or patients having CABG and 10 patients who underwent Valve surgery. Seven hundred fifty eight patients were further excluded having indications for emergency urgent cardiac catheterization. (ACS, Acute Coronary syndrome). Finally 368 patients were included. (Fig.1).

The ethical approval of this study was taken from Ethical Review Board of TABBA Heart Institute Karachi, Pakistan. Data was collected on the patients' demographic features, clinical risk factors, clinical symptoms and outcomes of noninvasive tests. Definition of patients with non-obstructive coronary artery disease was taken as the stenosis of less than 50% in all vessels. The degree of stenosis was determined by the treating physicians.

We categorized symptoms into two types: asymptomatic or stable angina / angina equivalent. Exercise stress test, myocardial perfusion scan, stress echo, cardiac CT, calcium score were all taken as non-invasive diagnostic tests in our study. All results were considered as positive or negative with positive results further classified into low, intermediate or high risk. The patient demographic characteristics, risk factors, symptoms and the

result of noninvasive testing were correlated with the presence of obstructive coronary artery disease, and non obstructive coronary artery disease.

Data was entered and analyzed through SPSS version 17. Continuous variables were calculated as medians and interquartile ranges, and categorical variables as percentages. Categorical variables were compared with the use of the chi-square test for significance of the data. Mean and standard deviation was calculated for quantitative variables like age, percentage diameter of stenosis.

RESULTS

During the study period, 1478 patients came for cardiac catheterization in the hospital. They were screened and finally we included 368 patients on the basis of our inclusion criteria.

Out of these, male were 283 i.e. 76.9% whereas female were only 85 i.e. 23.1%. Major associated risk factors in these patients were smoking (55 patients i.e. 14.9%), Diabetes (169 patients i.e. 45.9%) and Hypertension (275 patient i.e. 74.7%). Out of 169 diabetics, 122 (72.2%) were on oral medical therapy where as 30 patients (17.8%) were

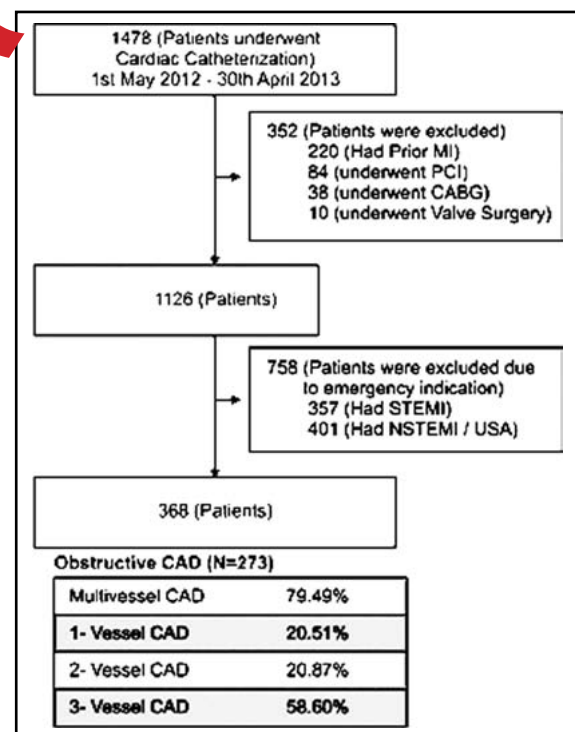


Fig.1: Study population and rate of obstructive coronary artery disease.

Myocardial Infarction (MI), Percutaneous Coronary Intervention (PCI), Coronary Bypass Grafting (CABG), Unstable angina (USA), Coronary Artery Disease (CAD)

Table-I: Noninvasive test results.

| Test Modality | No. of cases | Positive | | | Negative |
|-----------------------|--------------|-----------|--------------|-----|----------|
| | | High | Intermediate | Low | |
| ETT * | 55 | 25 | 28 | 02 | 0 |
| Stress echocardiogram | 08 | 03 | 04 | 01 | 0 |
| MPI ** | 93 | 52 | 32 | 01 | 8 |
| CMR *** | 0 | 0 | 0 | 0 | 0 |
| Cardiac CT **** | 03 | 02 (SVD), | 01 (Normal) | | |
| Calcium score | 02 | 01 (177), | 01 (4140) | | |
| Total | 161 | | | | |

* (ETT) Exercise Tolerance Test,

** (MPI) Myocardial perfusion imaging,

*** (CMR) Cardiac Magnetic resonance Imaging,

**** (CT) Computed Tomography.

taking insulin. Remaining 17 patients were on diet control. Independent predictor of CAD were Family history of Premature CAD [94 patients (25.5%)], Dyslipidemia [154 (41.8%)], on Dialysis [2 patients (0.5%)], Peripheral Arterial Disease [1 patients (0.3%)] and Cerebrovascular Disease [4 patients (1.1%)]

Out of 368 patients included in the study, 161 (43.75%) were tested noninvasively whereas remaining 207 (56.25%) were without noninvasive testing. Out of 161 noninvasive patients, MPI was done in 93 cases whereas in 55 cases ETT was done. (Table-I)

According to angiogram finding, non obstructive patients were 95 (25.81%) and obstructive coronary artery disease was seen in 273 patients (74.19%) (Table-II). Among the obstructive coronary disease most of the cases were of 3 vessel diseases (131 cases i.e. 58.60%), whereas 2 vessel and single vessel were almost equal (57 and 56 cases respectively). Among the 3 vessel CAD 29 presented with atypical and 131 typical symptom. In 2 vessel CAD were typical and 11 were atypical and in single vessel atypical were 9 and typical were 11.

Overall median age of patients was 57 years. The ratio of females compared to males was statistically significant in Non-Obstructive Disease v/s Obstructive Disease. Out of the 85 females, 43 were in obstructive coronary disease which is only

15.8% of the cases in this group whereas in Non-Obstructive Disease group they were 42 but it is 43.8% of the cases in this group which is statistically significant at $P < 0.001$. (Table-III)

Regarding Risk factors, diabetes, Dyslipidemia Peripheral Arterial disease, cerebrovascular disease, and hypertension were found higher in obstructive coronary disease but it had no statistical significance. BMI was found normal in both the groups whereas Family history of CAD was higher in Non-Obstructive Disease (Table-III).

DISCUSSION

Guidelines for triaging patients for cardiac catheterization recommend that in all elective patients, a risk assessment and noninvasive testing should be done in all cases until and unless it is felt to the angiography directly. In a study⁵, the median age was 61 years, out of which, 52.7% of the patients were men. In our study the median age was 57 whereas 76.9% were men which are higher to the corresponding study. Similarly, in the same study, 6.0% had diabetes, and 69.6% had hypertension. In our study, Diabetics were around double i.e. 45.9%, and Hypertensive was slightly higher (74.7%). Non obstructive CAD (defined as $<50\%$ stenosis in all vessels) was reported in 59% of the patients in the corresponding study⁵ whereas in our study it was recorded up to 25.8%.

In a report published by the RAND Corporation in 1992, between 9 - 36% of patients who underwent invasive angiography were found to have normal coronary arteries, but the findings were limited by varying definitions of normal and by varying radiographic systems.⁶ Findings from the Coronary Artery Surgery Study (CASS), involving 21,487 angiograms, showed that 18.8% of patients had non-obstructive coronary artery disease, which was defined as stenosis of less than 50% in all vessels.⁷ Data from the Society for Cardiac Angiography and Interventions (SCAI) Registry, which are somewhat more recent than the CASS findings but are still more than 15 years old, showed that between 20 - 27% of patients had normal coronary arteries and between 30 and 35% of patients had stenosis of

Table-II: Coronary angiogram / non invasive breakup.

| Obstructive CAD* | | Non-Obstructive CAD | |
|----------------------|-------------------------|----------------------|-------------------------|
| 273 (74.2%) | | 95 (25.8%) | |
| Non invasive Testing | No Non invasive Testing | Non invasive Testing | No Non invasive Testing |
| 133 (48.71%) | 140 (51.28%) | 28 (29.47%) | 67 (70.53%) |

* CAD (Coronary Artery Disease).

Table-III: Baseline characteristics of patients.

| Characteristics | Total (N=368) | Obstructive Coronary Artery Disease (N=273) | Non-Obstructive Coronary Artery Disease (N=95) | p value |
|---|------------------|--|---|---------|
| Age (Year) | | | | |
| Median | 57 | 58 | 54 | <0.001 |
| Interquartile range | 50-64 | 51-65 | 47-62 | |
| Female sex (%) | 23.1 | 15.8 | 43.8 | <0.001 |
| Clinical Risk factors | | | | |
| Body-mass index * | 26.6 | 26.6 | 26.9 | 0.15 |
| Median Interquartile range | 23.9-29.7 | 23.8-29.4 | 22-32.3 | |
| Recent/Current Smoker (%) | 14.9 | 18.4 | 5.3 | 0.002 |
| Diabetes (%) | | | | |
| Any | 37.8 | 39 | 34.4 | 0.68 |
| Insulin | 8.2 | 7.7 | 9.4 | |
| Hypertension (%) | 74.7 | 76.5 | 69.8 | 0.19 |
| Family History of CAD (%) | 25.5 | 24.6 | 28.1 | 0.005 |
| Dyslipidemia (%) | 41.8 | 43.0 | 38.5 | 0.44 |
| Peripheral Arterial disease (%) | 0.3 | 0 | 0.0 | 0.55 |
| Cerebrovascular disease (%) | 1.1 | 1.1 | 1.0 | 0.96 |
| Chronic Obstructive Pulmonary Disease (%) | 0.3 | 0.4 | 0.0 | 0.55 |
| Clinical presentation (%) | | | | |
| No Angina | 18.8 | 17.3 | 22.9 | 0.22 |
| Stable Angina | 82.7 | 82.2 | 77.1 | |

* The body-mass index is the weight in kilograms divided by the square of the height in meters.

less than 50% in all vessels.^{8,9} Although these data were derived from more than 200,000 patients over the course of several years, they were obtained before the current increase in both noninvasive imaging and the use of cardiac catheterization and reflect a broad spectrum of patients undergoing angiography, including those who were being evaluated for acute myocardial infarction and other emergency or urgent indications.

In our study we have excluded those patients who had known coronary artery disease, and those who are undergoing angiography in the setting of acute coronary syndrome or before angiography before valvular surgery. The number of patient in our study is very small because it's a single centre study as compared to the comparative studies. We also reviewed the baseline characteristics of the patient and found age, male gender, smoker, family history of premature coronary artery disease and symptoms as strong predictor of coronary artery disease and these findings are supplemented by Diamond and Forrester¹⁰ and was validated in independent clinical data sets.¹¹

We also evaluated pattern and result of noninvasive testing in patient undergoing elective coronary angiogram. We found that only 43.75% had undergone noninvasive testing, this number is very much low as compared to study by Patel et

al.,⁵ in which 84% of patient underwent noninvasive risk stratification prior to coronary angiogram. This reflects the trend towards directly sending patients to the catheterization lab in most cases without prior doing noninvasive risk stratification. We also found that most of the patients that we have sent for noninvasive testing were found to be positive and fall in intermediate and high risk group suggesting a need for coronary angiogram.

CONCLUSION

Only 18.2% cases had gone for inappropriate coronary angiogram procedure which could be avoided just by following the AHA guidelines. However on the other hand it shows that in this hospital we are going to proceed on appropriate angiogram in 81.8% cases, and the rest might be due to patient preference, non availability of the required funds, operator's variations in patient's selection and in some cases condition of the patient play a role in going for direct angiographic procedure.

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Authors Contribution:

INI conceived, designed and did writing & editing of manuscript.

MR did statistical analysis.

NK, RM, ANK did data collection.

INI takes the responsibility and is accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.