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PATTERN OF ANGIOGRAPHIC FINDINGS IN PATIENTS WITH STABLE ANGINA HAVING HIGH RISK DUKE SCORE ON EXERCISE TESTING

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Contribution

SNA,AS conceived the idea, designed and conducted the study. BAQ,KAH helped in acquisition of data and did statical analysis. All authors contributed significantly to the submitted manuscript.

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ABSTRACT

Objectives: The objective of this study was to show coronary angioghraphic pattern in patients having high duke treadmill.

Methodology: This cross sectional study was conducted between 28th March 2015 to 27th Sepetember 2015 at Cardiology Department of Chaudhary Pervaiz Elahi Institute of Cardiology, Multan. Patients with stable angina having high Duke's score that is less than 11, between 35-60 years of age of both genders were selected. Patients with history of myocardial infarction, unstable angina, heart failure and pregnancy were excluded. After this coronary angiography was conducted in all these patients. Findings were noted as no stenosis, single vessel disease, double vessel disease, triple vessel disease and left main stem disease.

Results: Mean age of patients was 52.42 ± 4.78 years. Out of total 220 patients, 126 (57.27) were females ,with female to male ratio of 1.3:1. Triple vessel disease was most common angiographic finding and was seen in 82 (37.27%) patients followed by left main stem disease in 73 (33.18%) patients. Double vessel disease, single vessel disease and no stenosis in 39 (17.73),18 (8.18%) and 08 (3.64%) patients respectively.

Conclusion: This study concluded that severity of angiographic patterns correlate significantly with high risk Duke's trade mill score on exercise testing in patients with stable angina.

Key Words: Duke score, Exercise testing, Triple vessel disease , Left main stem , Angiographic patterns.

INTRODUCTION

Cardiovascular diseases are currently the leading cause of death in industrialized countries.[1] Ischemic heart disease (IHD) is the most prevalent manifestation of these including silent ischemia, stable angina pectoris and acute coronary syndromes, (ACS).[2] IHD is caused by atherosclerosis affecting the coronary arteries. In stable angina, blood and oxygen supply to the myocardial tissue is diminished because of obstructive atherosclerosis and ischemia occurs when the demand increases, such as during exercise.[3]

Atherosclerotic disease is the main cause of CAD . Patients with a coronary stenotic lesion of 50% or more may result in symptoms of ischemia during increased physical demand. These patients are not able to increase their coronary blood flow during stress to match the increased myocardial metabolic demand, thus they experience angina.[4] The diagnosis of coronary heart disease (CHD) as the cause of chest pain requires the use of a careful clinical history as well as additional investigations.[5,6] Coronary angiography is the gold standard test for identifying the presence and extent of atherosclerotic coronary artery disease (CAD). Fortunately, the associated risks have decreased significantly due to advanced equipment design, improved peri-procedural management, and increased experience of diagnostic centers and operators.[7]

The exercise tolerance test has been used to assess patients who present with chest pain and intermediate pre test probability of ischemic heart disease. Duke's treadmill score derived from the test risk, stratify these patients. Many non-invasive stress tests are available involving stress with echocardiography or gamma camera scan or positron emission tomography (PET) scan. The exercise ECG is cheap and easily available test.

The limited sensitivity and specificity of standard exercise ECG testing for detection of coronary artery disease have stimulated increased use and development of above mentioned non-invasive stress imaging technologies.[10] However, the added diagnostic accuracy of stress imaging tests is associated with substantially higher cost. Diagnostic and prognostic predictive accuracy increases when multiple pieces of information from the patient's clinical history and the treadmill test are integrated. Combining clinical and test information thus provides an opportunity to make efficient use of key predictors at each stage of an intervention or risk assessment at substantial cost savings.[11,12]

The most popular validated treadmill score comes from Duke University and is based upon data from 2758 consecutive patients seen from 1969 through 1980 with a median age of 49 who had chest pain and underwent both exercise treadmill testing and coronary angiography.[13] The Duke treadmill score uses three exercise parameters: Exercise time, ST elevation and Exercise angina.[14] Patients are then classified as low, moderate or high risk according to the score. In one study patients who were found to have high risk duke score, 74% were documented to have severe triple vessel coronary artery disease or left main stem disease on angiography.[15] In one Iraqi study, exercise tolerance test and Duke's score was compared with findings of invasive coronary angiography. It showed that in the low risk Duke's group, the coronary angiography results were mainly normal (40%) of single vessel disease (40%) and rarely showed double (10%) or triple vessel disease (10%) and no left main stem disease was found while for those with high duke score triple vessels disease was present in 40.8% and left main stem disease in 37%, while it showed double vessel disease in 18.5% and rarely showed single vessel disease (3.7%).[16]

We have conducted this study in our local population to evaluate the proportions of patient with stable angina having high duke score turn out to have triple vessel disease, left main stem disease, single vessel disease or normal angiography. This would enable us to emphasize the utilization of this simple non-invasive test to develop a better priority list for our patients who need to undergo urgent angiography and receive a proper surgical or medical intervention.

METHODOLOGY

It is a cross sectional study conducted between 28th March 2015 to 27th Sepetember 2015 with the objective to determine the angiographic findings in patients with stable angina having high risk Duke score on exercise testing. After approval from local ethical committee, patients with history of chest pain for the first time, occurring on exertion and relieved by taking rest and between 20 to 40 years of age of either gender presented to Cardiology Department of Chaudhary Pervaiz Elahi Institute of Cardiology Multan, were selected. Informed consent was taken from patients.

All patients were evaluated thoroughly with detailed history, physical examination, resting ECG and Exercise ECG testing. Duke score was calculated in all these patients . Patients who were found to have high risk were included in the study. Patients were excluded from study who had history of myocardial infarction, ECG changes suggestive of unstable angina or myocardial infarction, heart failure or other contraindications of ETT.

After this angiography was conducted in all these patients and findings were noted. Duke prognostic treadmill score was defined as follows: Exercise time (minutes based on the Bruce protocol) - (5 x maximum ST segment deviation in mm) – (4 x exercise angina [0=none, 1=non limiting, and 2= exercise limiting]). Patients were classified as low, moderate, or high risk according to the score and only high risk patients were undergo angiography.

- Low risk ---- score $\geqslant +5$
- Moderate risk ----- score from -10 to +4
- High risk ----- score $\leqslant -11$

The data was entered and analyzed by SPSS version 20.0. Descriptive statistics were used to calculate mean and standard deviations for age and smoking pack years. Frequencies and percentages were calculated for gender and angiographic findings (no stenosis, single vessel disease, two vessel disease, left main stem disease and triple vessel disease). Effect modifiers like age, gender and no. of smoking pack years were controlled by stratification and chi-square test was used to see their effect on outcome. $P \leqslant 0.05$ was taken as significant.

RESULTS

About 220 patients were included in the study. Age range in this study was from 35 to 60 years with mean age of 52.42 $\pm$ 4.78 years. Majority of the patients [74 (33.64%)] were between 55 to 60 years of age. Out of 220 patients, 126 (57.27) were females with female to male ratio of 1.3:1. Mean smoking pack years in our study was 1.57 $\pm$ 0.89 packs with majority of patients i.e. 131 (59.55%), were <2 packs daily

In all the patients, angiography was carried out and findings have shown in Table 1. Triple vessel disease was most common finding and was seen in 82 (37.27%) patients followed by left main stem disease in 73 (33.18%) patients, double vessel disease in 39 (17.73) patients, single vessel disease in 18 (8.18%) and no stenosis in 08 (3.64%) patients. Stratification of age groups with respect to angiographic findings has shown in Table 2 which showed significant difference in age groups in all disease while there was no significant difference between genders as shown in Table 3. Stratification of no. of smoking pack years has shown in Table 4 and statistical significant difference was found in all disease.

DISCUSSION

Exercise testing is the most widely used technique for assessing prognosis of ischemic heart disease in patients who are able to withstand exercise and who have no substantial abnormalities in the resting electrocardiogram (ECG).[19,20] It is assumed that the general population of patients with suspicion of ischemic heart disease and a low-risk exercise test result have a favorable prognosis.[21,22] However, patients with classic chronic stable angina are at a high risk of coronary artery disease and therefore have a higher risk of adverse events than those with a lower pretest probability of coronary artery disease. Adverse events

Table 1: Angiographic Findings in study population (n=220)

Angiographic Findings	Frequency (n)	Percentage %
No stenosis	08	3.64
Single vessel disease	18	8.18
Double vessel disease	39	17.73
Triple vessel disease	82	37.27
Left Main stem disease	73	33.18

Table 2: Stratification of Age Groups with Respect to Angiographic Findings in study population (n=220).

Angiographic Findings		35-50 years (n=91)	51-60 years (n=129)	P-value
No stenosis	Yes	06 (6.59%)	02 (1.55%)	0.049
	No	85 (93.41%)	127 (98.45%)	
Single vessel disease	Yes	12 (13.19%)	06 (4.65%)	0.023
	No	79 (86.81%)	123 (95.35%)	
Double vessel disease	Yes	24 (26.37%)	15 (11.63%)	0.005
	No	67 (73.63%)	114 (88.37%)	
Left main stem disease	Yes	27 (29.67%)	46 (35.66%)	0.353
	No	64 (70.33%)	83 (64.34%)	
Triple vessel disease	Yes	22 (24.18%)	60 (46.51%)	0.000
	No	71 (75.82%)	69 (53.29%)	

Table 3: Stratification of Gender with Respect to Angiographic Findings in study (n = 220).

Angiographic Findings		Male (n=94)	Female (n=126)	P-value
No stenosis	Yes	03 (3.19%)	05 (3.97%)	0.761
	No	91 (96.81%)	121 (96.03%)	
Single vessel disease	Yes	10 (10.64%)	08 (6.35%)	0.251
	No	84 (89.36%)	118 (93.65%)	
Double vessel disease	Yes	21 (22.34%)	18 (14.29%)	0.122
	No	73 (77.66%)	108 (85.71%)	
Left main stem disease	Yes	31 (32.98%)	42 (33.33%)	0.956
	No	63 (67.02%)	84 (66.67%)	
Triple vessel disease	Yes	29 (30.85%)	53 (42.06%)	0.089
	No	65 (69.15%)	73 (57.94%)	

Table 4: Stratification of Smoking Pack Years with Respect to Angiographic Findings in study population (n=220).

Angiographic Findings		Pack per year <2 (n=131)	Pack per year >2 (n=89)	P-value
No stenosis	Yes	08 (6.11%)	00 (0.0%)	0.018
	No	123 (93.89%)	89 (100.0%)	
Single vessel disease	Yes	15 (11.45%)	03 (3.37%)	0.023
	No	116 (88.55%)	86 (96.63%)	
Double vessel disease	Yes	29 (22.14%)	10 (11.24%)	0.038
	No	102 (77.86%)	79 (88.76%)	
Left main stem disease	Yes	40 (30.53%)	33 (37.08%)	0.312
	No	91 (69.47%)	56 (62.92%)	
Three vessel disease	Yes	39 (29.77%)	43 (48.31%)	0.005
	No	92 (70.23%)	46 (51.69%)	

occur in the clinical course of certain patient populations with ischemic heart disease and at high clinical risk despite a low-risk exercise test result.[23]

Invasive angiography of coronaries is the gold standard test for the diagnosis of obstructive CAD and to quantify the disease. This invasive technique for imaging the coronary artery lumen remains the most accurate for the diagnosis of clinically important obstructive coronary atherosclerosis and less common non atherosclerotic causes of possible chronic stable angina pectoris. As with any invasive procedure, there are complications that are related to the test. Complications range widely from minor problems with short term sequelae to life threatening situations that may cause irreversible damage, if urgent care is not provided.[17,18]

It is an invasive investigation and carries a mortality risk of around 0.1% for elective procedures. This test therefore is done only with specific clinical indications for example angina not relieved by optimum medications and other high risk clinical features and high risk findings on stress test with a view revascularization. Left ventricular function can also be assessed with it apart from haemodynamic information. Patients identified as having increased risk based on high risk clinical features and high risk findings on stress test, coronary angiography is planned with a view to revascularization symptoms independent of the symptoms. Exercise stress testing is cheap and guides about the need of further invasive testing.

The exercise treadmill is used in the evaluation of symptomatic patients to predict the presence and extent of coronary artery disease and the short and long term prognosis.[21,22] In 1987, Mark and colleagues described a score derived from different exercise parameters including the duration of exercise during the test , ST-segment of ECG deviation including both its depression or elevation, and angina during exercise test [24]. This treadmill score has been shown to stratify prognosis accurately for both inpatient and outpatient ischemic heart disease populations.[15,25] This study was conducted to evaluate the proportions of patient with stable angina having high duke treadmill score and its relationship with different angiographic findings.

The mean age of patients in this study was 52.42 ± 4.78 years with majority of the patients [74 (33.64%)] were between 55 to 60 years of age. These findings were very much comparable with Abbase AH et al and Bogaty P et al who had a mean age of 56 and 50 years respectively but much lower than Sun Z et al who had a mean age of 66 years[16,26,27]. The prevalence of angina pectoris increases with age. Age is a strong independent risk factor for mortality. More than 150,000 Americans killed by CVD in 2005 were younger than 65 years. However, in 2005, 32% of deaths

from cardiovascular disease occurred before the age of 75 years, which is well before the average life expectancy of 77.9 years.[28] In our study, out of these 220 patients, 126 (57.27) were females and with female to male ratio of 1.3:1. Angina pectoris is more often the presenting symptom of coronary artery disease in women than in men, with a female-to-male ratio of 1.7:1. It has an estimated prevalence of 4.6 million in women and 3.3 million in men. On the other hand, many studies have shown male predominance.[14,15,25]

In our study, triple vessel disease was most common angiographic finding and was seen in 82 (37.27%) patients followed by left main stem disease in 73 (33.18%) patients, double vessel disease in 39 (17.73%) patients, single vessel disease in 18 (8.18%) and no stenosis in 08 (3.64%) patients.

In a study by Bogaty P et al, the coronary angiography findings in stable angina patients were normal (0%), single vessel disease (25.5%), double vessel disease (38.3%) and triple vessel disease (36.3%) [25]. While Sun Z et al in his study has shown the following findings of coronary angiography in stable angina patients; single vessel disease (19.7%), two vessel disease (43.7%) and three vessel disease (36.6%). Shaw LJ et al in his study has shown coronary angiographic result in high Duke's risk group as normal in 0.4%, single vessel disease in 5.9%, and double vessel disease in 15.7%, triple vessel disease in 39.5% and left main stem disease in 38.5% patients while Peters RM et al found this as 0%, 12.7%, 20%, 36.3%, and 31% respectively [15,26]. In another study by Lanza GA et al, single vessel disease was most common angiographic finding and was seen in 37.11% patients followed by double vessel disease in 29.38% patients, triple vessel disease in 17.53% and no stenosis in 16.0% patients [27].

Our study has shown that Duke's score is valid in detecting coronary artery disease especially patients with high duke score have triple vessels and left main stem disease (70.45%) which carry poor prognosis. Similar findings were also noted by many previous studies.[14,15,26] On the whole it is concluded that Duke's score is simple non-invasive test to develop a better priority list for our patients who need to undergo urgent angiography and receive a proper surgical / medical intervention.

CONCLUSION

This study concluded that the triple vessel disease was most common angiographic finding followed by Left main stem disease, double vessel diseases, single vessel disease and no stenosis in patients high risk Duke's score on exercise testing. Duke's score on exercise testing should be utilized in every patient with stable angina to develop a better priority list for patients needing coronary angiography.

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