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Original Article

Abnormal Screening ETT

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PATTERN OF CORONARY ARTERY DISEASE IN ASYMPTOMATIC SERVING SOLDIERS HAVING ABNORMAL SCREENING ETT

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ABSTRACT

Objectives: To validate the application of ETT screening and to assess the extent of CAD in serving soldiers.
Study Design: Comparative cross-sectional.
Place and Duration of Study: Study was conducted in AFIC/NIHD, from Oct 2018 to Jun 2019.
Methodology: Conducted in AFIC/NIHD for the duration of 9 months. Cases with abnormal ETT at screening were further worked up with Computed Tomographic (MSCT) Angiography. Those having critical disease underwent Coronary angiogram. All cases with severe or more disease, were worked for revascularization. Chi-square test was used to find association between ETT and its diagnostic yield and management modalities. A *p*-value <0.05 was taken as significant.
Results: A total of 256 cases with abnormal ETT were studied with 57.8% (148) cases from age group of 35-45 years. Majority of the cases 203 (76.6%) had normal CT angiography and 26 (10.2%) cases had any pattern of critical disease and 9 (3.5%) cases had calcium. Out of 256 cases 36 (14.06%) were proceeded with further work up with coronary angiogram. 31 out of these 36 cases revealed any pattern of critical CAD with 19 (7.4%) proceeded to Percutaneous Coronary Intervention (PCI) and 14 (5.5%) were offered Coronary Artery Bypass Grafting (CABG). Results show statistically significant association between diagnostic techniques and treatment modality.
Conclusion: The application of ETT screening for diagnosis of occult CAD is helpful.

Keywords: Coronary artery disease (CAD), Computerized tomography (CT), Exercise tolerance test (ETT).

INTRODUCTION

Coronary Artery disease (CAD) is a major cause of death and disability in developed countries. Although CAD mortality rates worldwide have declined over the past four decades, but it is responsible for about one-third or more of all deaths in individuals over age 35[1-3]. Estimates show that nearly one-half of all middle-aged men and one-third of middle-aged women in the United States will develop some manifestation of CAD[4].

In its 2018 report, Heart Disease and Stroke Statistics update of the American Heart Association (AHA) reported that 16.5 million persons ≥20 years of age in the United States have coronary artery disease (CAD), with a slight male predominance (55 percent)[3]. The reported prevalence increases with age for both women and men. The Global Burden of Disease Study 2013 estimated that 17.3 million deaths globally in 2013 were related to cardiovascular diseases (CVD), a significant (41%) rise since 1990[5].

In Pakistan CAD is rapidly evolving into an epidemic affecting both the life expectancy and quality of life. This attributes to a lot of factors including gross shifting of lifestyle to western pattern. In one study 17.5% of the general population has CAD[6].

The primary purpose of screening for CAD is to identify patients whose prognosis could be improved with an intervention (in this case, medical therapy for risk factors or coronary revascularization). Screening for CAD should be distinguished from risk estimation for CAD. Both are performed in asymptomatic individuals, and both aim to improve outcomes with interventions, if warranted. However, screening for CAD identifies existing disease, while estimating the CAD risk does not directly identify existing

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disease but rather the likelihood of any future CAD event.

In tertiary care screening for CAD is being carried out by application of annual ETT for all serving soldiers after the age 30 years. A significant number of them are being referred or transferred to cardiac centres for further evaluation. Out of them a sizeable number turns to have Coronary artery disease at angiogram (CT angiogram or Coronary angiogram) and some percentage even requires coronary intervention. The subsequent management and service disposal depends upon the presence and extent of disease in angiogram.

The study will help to assess the increasing occurrence of CAD in active soldiers and emphasize to look for and control risk factors. The objective of our study is to validate the application of this screening and to assess the extent of CAD in asymptomatic soldiers.

Operational Definition

CAD (Coronary Artery Disease) any evidence of stenosis in coronary arteries at angiogram (Computed Tomogram Coronary angiogramor Conventional angiogram)

METHODOLOGY

This comparative cross-sectional study was conducted in AFIC/NIHD for the duration of 9 months from 1st October 2018 to 30th June 2019 using consecutive sampling. A sample of 256 patients was selected who presented as asymptomatic male serving soldiers between ages 30-55 years irrespective of smoking status and irrespective of premorbids (Diabetes, Hypertension) with abnormal ETT results on annual screening test andwere included in the study whereas female cases/patients and patients with Known CAD were excluded from the study.

Data Collection Procedure

All cases with abnormal ETT at screening both borderline and positive were further worked up with Multi Slice Computed Tomographic (MSCT) Angiography. Normal CT angiography cases were declared fit from cardiac side and cases having minor or subcritical disease on CT angiography were placed on medical treatment only. Those having critical disease or calcium deposits were further worked up with Coronary angiogram. Further management path was defined by angiographic presence, distribution and extent of disease. All cases with severe or more disease, were worked for revascularization including Percutaneous Coronary Intervention (PCI) or Coronary Artery Bypass Grafting (CABG).

After consent of individual data was taken and entered in a data collection form. Data collection form included details of demography, risk factors, diagnostic procedure and management including any intervention i.e., Percutaneous Coronary Intervention (PCI) or Coronary Artery Bypass Grafting (CABG).

Data Analysis Procedure: Data recording, storage, assessment and analysis was done by using SPSS software version 23 with breakdown of frequencies of disease patterns and extent against variables of age, smoking, hypertension, diabetes mellitus and finally management modalities. Continuous variable data was presented in mean and standard deviation. Categorical variable data is presented in frequencies and percentages. Chi-square test is used to find association between ectatic vessel and the diseased vessel on coronary angiogram. A p-value<0.05 is taken as significant.

RESULTS

A total of 256 cases with abnormal ETT were studied with 57.8% (148) cases from age group of 35-45 years, followed by 23% with age above 45 years and 19.1% were less than 35 years old. Fifty three (20.7%) cases had ETT borderline for ischemic changes and 203 (79.3%) had ETT positive for ischemia or angina. Nineteen (7.4%) of evaluated cases had diabetes mellitus and 52 (20.3%) were hypertensive. 102 (39.9%) cases were having smoking history with 17.2% Ex-smokers and 22.7% active smokers. A significant number of cases 52 (20.3%) had positive family history for CAD having at least one first degree relative a labelled case of ischemic heart disease (table-I).

Majority of the cases 203 (76.6%) had normal CT angiography and the remaining 59 (23.4%) had some form of disease on CT angiography

Table-I: Baseline caharaceristics and risk factors of study participants (n=256).

Characteristic	N (%)
Age	
<35 years	49 (19.10)
35-45 years	148 (57.80)
>45 years	59 (23.0)
DM	19 (7.40)
HTN	52 (20.3)
Smoking History	
Non-smoker	154 (60.3)
Ex-smoker	44 (17.3)
Current smoker	58 (22.7)
Family History	52 (20.3)

Table-II: Coronay angiogram results and PCI intervention of study participants.

Coronay angiogram		Frequency n=256	Percentage
Not done / Required		220	(85.9)
Normal		1	(0.4)
Minor / Sub cortical CAD		4	(1.6)
Critical SVCAD		14	(5.5)
Critical DVCAD		5	(2.0)
Critical TVCAD		12	(4.7)
PCI	Yes	237	(92.6)
	No	19	(7.4)

Table-III: Association between CT/ Coro-angiography and treatment modality.

	Treatment Modality		
Diagnosis of CAD on	**Medical treatment (n=225)**	**Interven-tion (n=31)**	***p*-value**
CT angiography	29 (13%)	31(100%)	0.001
Coro-angiograpy	5 (3%)	31(100%)	0.001

with 18 (7%) having minor disease, 6 (2.3%) having subcritical disease and another 26 (10.2%) had any pattern of critical disease. Nine (3.5%) cases had spotty or dense calcium on CT angiogram (fig-1).

All the subjects with critical disease or calcium on CT angiogram were further worked up with coronary angiography. In one case (0.4%) CT angiogram could not be carried out because of renal impairment and the case was further worked up with myocardial perfusion scan.

Out of 256 cases 36 (14.06%) were proceeded with further work up with coronary angiogram. One (0.4%) had normal study, 4 (1.6%) showed minor or subcritical CAD (Coronary Artery Disease), both required no intervention. Thirty one (12.2%) cases revealed any pattern of critical CAD (table-II).

All cases with critical CAD on coronary angiogram required coronary intervention in the form of PCI (Percutaneous Coronary Interven-

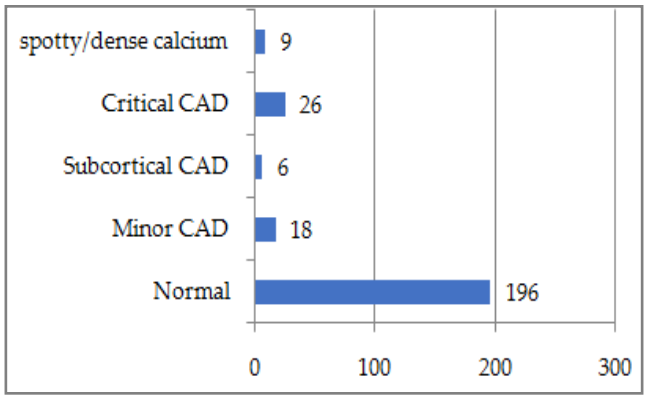

Figure: Computerized tomographic findings amongst participants (n=256).

tion) or surgical intervention of CABG (Coronary Artery Bypass Grafting). Nineteen (7.4%) underwent PCI with drug eluting stents and or balloons (table-III), while 14 (5.5%) were offered CABG out of them 2 (0.8%) were unwilling for surgery.

Regarding management strategies, 78.1% had no CAD evidence so requiring either no treatment or non-cardiac treatment. 12.1% required coronary intervention in the form of PCI or CABG while the remaining 9.8% were placed on drug therapy for CAD with lifestyle modification advice.

Finally results show that ETT is a reliable initial screening test for diagnosis of CAD in asymptomatic cases but it cannot be used alone as a reliable method to determine the course of treatment whereas CT angiography and coronary angiography are reliable methods to be used as diagnostic tools forchoice of correct mode of management. Results show statistically signifi-

cant association between diagnostic techniques (CT angiography/Coro-angiography) and treatment modality. Chi-square was used to develop the association between different categorical variables. Among the risk factors family history and age showed significant association with the treatment choice (table-III).

DISCUSSION

Thegrowing prevalence of CAD with its increasing share in the annual mortality burden validates more research and attention. With time cases of CAD are increasing and they have all impact on our health care system and active manpower resource. The due response requires ways to early diagnosis especially through screening tests in asymptomatic population of at-risk community. Screening of a population or large community mandates employment of an efficient, readily available, easily conducted, accurately interpreted and cheap screening mode like ETT. An insight into the causative or associative risk factors, lifestyle and diagnostic work is requirement of time. Further workup of abnormal ETT cases warrants for studies of coronary arteries and myocardial contractile efficacy on echocardiogram. Our study conduct is justified in a community with a significant burden of CAD. The methodology and sequential workup were optimum as our cases were those with positive screening ETT and they were further evaluated with transthoracic echocardiogram, baseline investigations then proceeded to CT angiogram and coronary angiogram if required. Depending upon the pattern and extent of disease all cases with CAD were categorized to one of three modalities of medical treatment, PCI and CABG. All of them were counselled for strict compliance, follow up, control of risk factors if any and lifestyle modifications.

The study results are comparable to those of an international study ''Coronary Computed Tomography Angiography as a Screening Tool for the Detection of Occult Coronary Artery Disease in Asymptomatic Individuals'' conducted by Eue-Keun Choi *et al* and published in Journal of the American College of Cardiology in Jul 2008[7]. The mentioned study identified CAD in 22% of asymptomatic individuals while our study identified CAD in 23% of individuals. The slight difference may be attributed to the time gap and the median age difference.

If we talk to a comparison at national level studies, only few studies can be found in general. A study ''Prevalence of cardiovascular diseases in Punjab, Pakistan: A cross-sectional study'' by Zubair *et al* published in Journal of Public Health in October 2018 shows CAD in 17.5% of asymptomatic individuaIs while our study identifies CAD in 23.0% (58) of cases[6]. So, the burden of silent undiagnosed CAD looks to be much more than earlier estimates.

In terms of modifiable risk factors, we studied few important ones like smoking, diabetes mellitus and hypertension. Data from US national representative survey, five modifiable risk factors like elevated cholesterol, diabetes, hypertension, obesity, and smoking were accounted for one-half of CVD deaths inadults aged 45 to 79 years[8]. The adverse consequences of multiple risk factors are, at least, additive. In the Framingham Heart Study involving over 5000 cases, those with all five risk factors had a 10-year risk of a first CAD event of 25 to 30 percent[9]. The preventable fraction of CAD mortality attributable with these risk factors was 54 percent for men and 50 percent for women. Our study showed that out of 256 cases with abnormal ETT, 20.3% had hypertension, 39.9% were having smoking history and 7.4% had diabetes mellitus.

Regarding employment of ETT as screening modality in asymptomatic individuals with no signs or symptoms suggestive of CAD, American College of Cardiology Foundation Appropriate Use Criteria Task Force report says exercise stress testing can indirectly identify the presence or absence of underlying CAD by assessment of myocardial ischemia[10-13]. Our study validates the importance of ETT as a screening test for diagnosis of CAD in its latent phase once the cases or its victims are symptoms free[14-18]. The association

of positive ETT with diagnosis of CAD is significant although it association with management strategies proved insignificant.

CONCLUSION

The study emphasizes that the application of ETT screening for diagnosis of CAD is helpful. Abnormal ETT results should be evaluated by CT angiography and/or Coronary angiography. Our study also shows a significant number of cases having modifiable risk factors like smoking, hypertension and diabetes mellitus thus warranting measures for awareness, counselling and treatment of these adversary risk factors.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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