Clinical Medicine

False Positive Treadmill Response Among Asymptomatic Air Force Personnel

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Fifty asymptomatic subjects who were diagnosed as cases of "asymptomatic Coronary Artery Disease(CAD)" on treadmill stress testing were further evaluated by invasive and non-invasive methods. Coronary arteriography and Echocardiography were done in all and Multiple Gated Acquisition (MUGA) and Stress Thallium-201 studies were carried out in selected cases. Coronary angiography was normal in 33 (66%) cases; 6(12%) cases had insignificant (less than 50% obstruction) and 11 (22%) subjects had significant coronary artery obstruction. While Stress Thallium studies correlated well with the results of coronary angiography, MUGA studies did not. Diagnosis of the cases showing normal coronary angiograms were changed from "Asymptomatic CAD" to "Investigation-CVS-NAD".

Keywords: Coronary artery disease, coronary angiogram, stress testing.

Treadmill Stress Testing (TMT)is presently used as screening procedure for diagnosis of latent coronary artery disease in asymptomatic aircrew showing repolarisation abnormalities in their ECGs at rest or after Double Master's Test (DMT)[1]. Apart from an abnormal TMT response, majority of them have no other risk factors. In the light of the present knowledge it can be said that many of these aircrew considered unfit for flying on account of presumed coronary artery disease (CAD), are / were not suffering from these disease [2-6]. Using coronary angiography as the "Gold Standard", the TMT has shown significant number of false positive and false negative responses[2,3]. It was therefore decided that asymptomatic cases with abnormal TMT should be subjected, with informed consent, to coronary angiography in order to rule out CAD. The correlation of angiographic findings with TMT findings in 50 patients and findings of Multiple Gated Acquisition (MUGA) and Stress Thallium-201 studies in selected cases are presented in this article.

Material and Methods

A total of 50 cases who had evidence of exercise induced myocardial ischaemia on TMT were taken up for this study; 47 were Air Force Personnel and 3 were from civil aviation. All of them were diagnosed as "Asymptomatic CAD".

All patients were subjected to cardiac cathererisation and coronary angiography at All India Institute of Medical Sciences, New Delhi and GB Pant Hospital, New Delhi. Cardiac catheterisation was performed using Seldinger techniques. Right and left heart studies were done using USCI and pigtail 7F catheters by percutaneous right femoral vessel puncture. Selective coronary cine arteriography by Judkins technique and left ventricular angiography were performed using Urograffin 76% contrast injections. The angiograms were filmed in various views using 35 mm film (Fig 1-4). Data were obtained to determine the anatomical state of the coronary arteries and state of left ventricle in terms of shape size and contractility. Cases with normal coronaries, minimal coronary obstructions (less than 50%) and with significant obstruction (more than 50%) have been grouped as Group I, II and III respectively. Echocardiogram (2D and M Mode) was carried out in all the cases.

MUGA study was carried out at the Institute of Nuclear Medicine and Allied Science (INMAS), New Delhi, on 13 cases in whom a high degree of suspicion of CAD existed. Thallium-201 scan was done in 7 cases where significant CAD was suspected. These studies were conducted with submaximal stress on bicycle ergometer. Thallium-201 was injected at peak exercise and imaging began within 10 minutes after injection.

Fig 1. Normal coronary Angiogram
Normal Right Coronary Artery (A) visualised
(Left Anterior Oblique View)

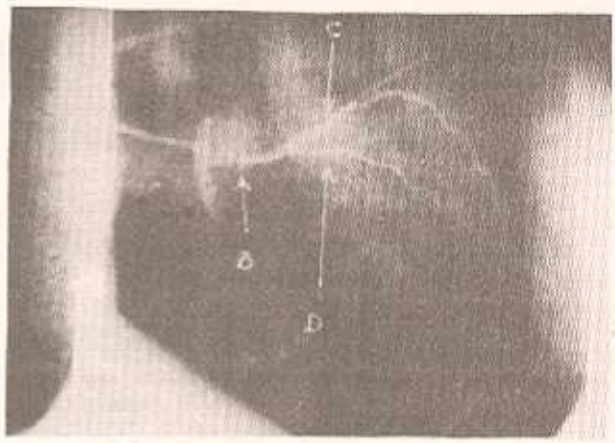

Fig 2. Normal coronary Angiogram
Normal left coronary (B), anterior descending (C) and circumflex (D) arteries visualised.
(RIght Anterior Oblique View)

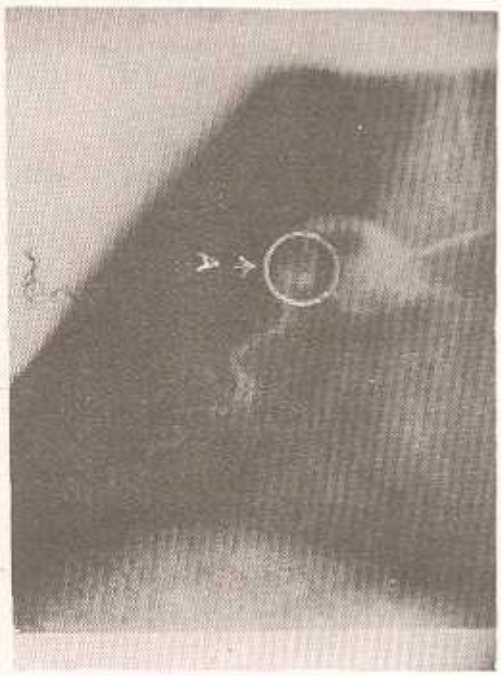

Fig 3. Coronary angiogram showing Multiple narrowings (A) in Right Coronary Artery.
(Right Anterior Oblique View)

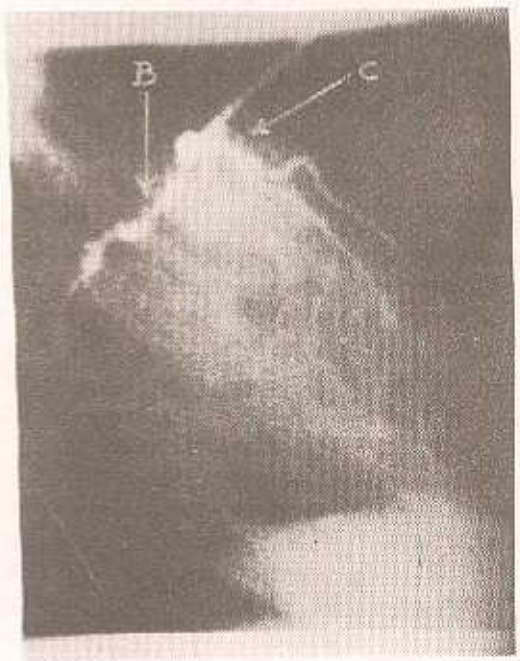

Fig 4. Coronary Angiogram showing proximal struction of left anterior descending (B) and complete obstruction of left circumflex (C) arteries
(Lateral View)

Results

Out of total 50 cases, 33 cases were found to have no CAD and 6 had insignificant CAD. Among these 6 patients, 5 had single vessel involvement and one had 3 vessel involvement. Left anterior descending artery (LAD) was involved in 3 cases. Eleven patients had significant CAD: 5 single vessel, 2 double vessel and 4 triple vessel disease (Table I).

Table - I Pattern of significant obstruction as seen in angiograms

Type of Disease (n)	Degree of Obstruction (%)	No. of Cases
(a) One vessel (5)		
1. LAD	50 - 70	—
	71 - 90	4
2. LCA	50 - 70	1
	71 - 90	—
3. RCA	Nil	
(b) Two vessel (2)		
1. LAD & LCA	50 - 70	—
	71 - 90	2
2. LCA & RCA	Nil	
(c) Left main (0)	Nil	
(d) Three vessel (4)	50 - 70	—
	71 - 90	4

LAD - Left Anterior Descending artery LCA - Left Circumflex artery RCA - Right coronary artery

Amongst 33 normal cases of coronary angiography, 13 had abnormal resting ECG. The remaining 20 cases had an abnormal ECG after DMT. Two out of 6 cases with insignificant obstruction and 6 out of 11 cases with significant disease had abnormal resting ECG. Out of the total 21 cases with abnormal resting ECG findings, 6 cases i.e., 29% had shown significant obstruction in coronary angiographic studies and the remaining 15 (71%) had normal coronaries or insignificant obstructions (Table II).

Table III describes the analysis of positive treadmill test in relation to coronary angiography.

Table - II Analysis of resting ECG in relation to coronary angiographic findings

Type of Cases	Coronary Angiographic Findings			
	Normal (Gp I)	Insignificant obstruction (Gp II)	Gp I&II	Significant obstruction (Gp III)
TMT +ve (n = 50)	33	6	39 (78%)	11 (22%)
Abnormal resting ECG (n = 21)	13	2	15 (71%)	6 (29%)

In 7 cases of mildly positive TMT, 5 had normal coronary angiography, one case each had insignificant and significant coronary obstruction respectively. In 13 cases of moderately positive TMT, 9 cases were angio negative, 3 cases had insignificant obstruction (below 50%) and one case had significant CAD. Out of 30 cases with strongly positive TMT findings, 19 were angionegative, 2 cases had insignificant (below 50%) obstructions and 9 cases had angiographically significant disease. Percentage analysis of the data indicate that in the total 50 TMT positive cases, only 22% were found angiopositive. Out of the 30 cases with strongly positive TMT, only 9 i.e. 30% had significant angiopositive findings and 70% were normal or with insignificant obstruction. In comparison, out of 20 mild and moderately positive TMT cases, only 2 i.e. 10% had significant angiographic obstruction.

Echo findings were found significant in 3 cases: 1 with mild mitral valve prolapse of anterior

Table- III Ana lysis of postive TMT findings in relation to coronary angiographic findings

TMT Findings	Coronary Angiographic Findings		
	Normal (Gp I)	Insignificant obstruction (Gp II)	Significant obstruction (Gp III)
Mildly positive (n = 7)	5	1	1(14%)
Moderately +ve (n = 13)	9	3	1(8%)
Strongly +ve (n= 30)	19	2	9(30%)

and posterior leaflets, 1 mild hypokinesia in the lower part of intraventricular septum and 1 mild hypokinesia in the lower part of anteroseptal region. Both cases of hypokinesia were found to have significant CAD on coronary angiography.

Out of 13 cases who underwent MUGA studies, 5 cases had significant CAD on angiography. Only one case in this group showed hypokinesia of apical and anteroseptal areas. Out of 7 cases studied for Thallium scan, 3 cases with significant CAD showed abnormalities. Two cases with insignificant coronary obstructions and 2 cases with no CAD had normal Thallium scan.

Discussion

Treadmill stress test had been extensively used in order to diagnose or evaluate cases with typical or atypical features of CAD [2-7]. TMT findings have been found to correlate well with the findings of the coronary angiography in this group[8]. However, when these two tests were done on totally asymptomatic subjects having abnormal ECG suggestive of CAD, the findings of the two tests did not correlate well suggesting that most of these subjects had false positive TMT[9]. Reports regarding correlation of TMT and coronary angiography amongst asymptomatic individuals are not many [3,11-13]. At present most of the workers do not recommend coronary arteriography to exclude or prove the diagnosis of CAD amongst asymptomatic subjects due to their percentage of false positive results, but the same is recommended for individuals like aircrew who are employed on sensitive duties [12,14,15].

Resting ECG is an insensitive test for detecting latent CAD in asymptomatic persons. The predictive value is high when it is abnormal, while a normal ECG does not exclude CAD[16]. In the present series the predictive value of resting abnormal ECG was found to be 29% (Table II).

The true incidence of false positive ST-segment response during TMT in the presumably healthy population is yet to be defined [17]. Borer et al[3] reported false positive TMT in 60% of asymptomatic individuals. In our series we found false positive TMT in 39 out of 50 ie., in 78% of the subject. The predictive value of TMT in relation to significant angiographic obstructions was 14%, 8% and 30% among mild, moderate and strongly positive TMT group respectively (Table III). In individuals with strongly positive TMT findings, chances of being significantly angiopositive were 30% compared to 10% in the combined group of mild and moderate TMT positive cases. However, even in the strongly positive TMT group, the false positive results still remained very high, viz. 70%.

The uncertainties regarding the degree of stenosis required to produce ischaemia during exercise will probably continue to complicate the correlation of angiographic and exercise test results since minimal lesion can result in ischaemic coronary events in some patients while others with relatively advanced degree of obstruction remain symptom free[10]. There are physiological reasons to explain the differences in relationship between TMT and coronary angiography. The angiogram defines the pathologic anatomy of the larger coronary arteries. It does not measure flow distal to the obstruction nor does it reveal small vessel disease. Furthermore, the coronary angiography is carried out at rest. The exercise ECG furnishes indirectly an indication of the adequacy of blood flow and oxygen supply to working cardiac muscle[15]. Nevertheless, coronary angiography is taken as the "Gold Standard"[7] and a further appraisal of TMT test results may best be clarified against coronary angiographic findings.

Froelicker et al[11] delabelled their coronary angio- normal cases of the diagnosis of CAD. In the present series, out of 50 TMT positive cases studied further for coronary angiography, only 11 cases had significant CAD and of these, 5 had single vessel disease, 2 had two vessel disease and 4 had three vessel disease. Diagnosis for those with normal coronary angiograms was changed to "CVS-investigation - NAD" and they were assessed fit for full duties.

In the present series, Echo studies (M Mode and 2D mode) were done in all 50 cases.

Two cases of significant Echo abnormalities, viz. low septal hypokinesia, belonged to angio positive group. Both had three vessel disease.

Out of the 13 cases undergoing MUGA studies, 8 cases belonged to angiographically normal group and their MUGA studies were normal; 5 cases had significant CAD and only one of these 5 cases had abnormal MUGA findings. As seen from the observation of the present study, MUGA studies did not give any additional information amongst the asymptomatic individuals.

Several workers demonstrated that exercises Thallium scintigraphy was highly specific (92%) and sensitive (89%) for the detection of CAD in asymptomatic patients with positive exercise tests[18,19]. In the present series, out of the 7 cases studies for Thallium scan, 3 cases belonged to the significant CAD and all the three showed abnormal Thallium scan response. The remaining 4 cases belonged to normal and insignificant obstruction groups and had normal response on Thallium scan. Though this test had been done in a small number of cases, predictive value of the test was found 100% in this series. It would be justified to carry out stress Thallium studies amongst those who have abnormal TMT findings suggestive of CAD.

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