CARDIOVASCULAR RISK FACTOR CLUSTERING AND CORONARY ARTERY DISEASE : A 4-YEAR FOLLOW UP STUDY OF 257 SERVICE PERSONNEL

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ABSTRACT

Two hundred and fifty seven service personnel with established diagnosis of (a) silent ischaemia (40.47%) (b) Q-infarction (25.68%) and (c) non-Q-infarction (33.85%) along with 50 age-matched controls were subjected to stress tests before and after identification and control of risk factors. Lack of exercise (63.0%), dietetic indiscretion (47.4%) and cigarette smoking (40.4%) were the main risk factors. Hypercholesterolaemia (22.1%), alcohol over-indulgence (17.1%), positive family history (16.3%), diabetes mellitus (9.7%) and hypertension (6.2%) were other contributing factors. Clustering or multiplicity of risk factors was seen in 61.1% cases. All patients were advised for control of risk factors along with necessary specific therapy wherever indicated. Initial stress test was positive in 83.3% of the total and on repetition, after 4 years, the positivity dropped to 45.9% with a rate of improvement of 44.9%. Patients with silent ischaemia showed the maximum improvement (57.8%) following the risk factor intervention. Only 4 cases (1.56%) showed deterioration with reinfarction during the 4-year follow up.

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KEY WORDS : Coronary disease; Risk factors; Prevention and control.

Introduction

Coronary artery disease (CAD) is a multifactorial disorder. Non-modifiable factors like age, sex, family history of CAD [1-5] and modifiable factors like excessive consumption of saturated fat [6], lack of physical exercise [3,7], and cigarette smoking [4,5,8], are well established risks for this disease. Associated diseases like obesity [9,10], hypertension [11,12] and diabetes mellitus [13] are other important risk factors resulting in increased incidence of CAD. Alcohol over-indulgence [14] can also add to the risk. Clustering or multiplicity of risk factors is usually the rule in heralding premature and serious CAD [8,15]. Reduction or abolition of these risk factors helps in quicker recovery and early rehabilitation [3,6,7,16] as well as reduction in morbidity and mortality [12]. This study was undertaken to identify the role of risk factors in patients with proved CAD and

to assess the changes in their disease-pattern following the control or abolition of the modifiable risk factors.

Material and Methods

Two hundred and fifty seven service personnel with established and confirmed diagnosis of ischaemic heart disease (IHD) form the material of this study. Fifty age-matched volunteers were also studied as controls. The patients of IHD had been initially treated at peripheral military hospitals and were referred to us after recovery and stabilisation. All available medical documents and electrocardiograms (ECG) were scrutinised in detail. The patients were divided into three diagnostic groups : (1) silent ischaemia (2) Q-infarction, (3) non-Q-infarction; controls formed the fourth group.

All patients and controls were subjected to detailed clinical and investigative

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evaluations : (1) Recording of present, past, family, personal histories. (2) General, physical and systemic examinations. (3) Laboratory tests like fasting and post-prandial blood sugar (GTT if required), serum cholesterol (lipid profile if required), blood urea, uric acid, serum creatinine. (4) Radiogram of chest, and (5) resting ECG.

Risk factors were identified during clinical evaluation of each case. A pre-set proforma was used to record these queries to maintain consistency. History of IHD and sudden death especially in young middle-aged males of the paternal and maternal side of family was asked for. Detailed history of smoking habits and alcohol consumption was obtained. Daily dietary habits of each case was asked in detail. Patients or controls taking frequently butter, ghee, whole egg, whole milk, red meat, using saturated oil as cooking medium, taking excess of fried food, dry fruits and sweets as well as having irregular eating habits were labelled to have "dietetic indiscretion". All subjects were asked details of day to day activities, type of work (sedentary or otherwise), mode of conveyance to work, participation in organised physical training, parade, games and personal exercise schedule. Each subject was also asked about any psychological stress including problems at work, interpersonal relationship in office and home.

Stress tests were performed on a Viagraph computerised treadmill exercise system (TMT). Exercise was carried out till achievement of target heart rate or till appearance of diagnostic ST displacement. Other factors influencing termination of TMT were complaint of precordial pain, giddiness, fatigue and muscle cramps or presence of persistent or progressively worsening ventricular arrhythmias. The absolute diagnostic criteria for positive TMT in our study were; (1) horizontal or downsloping ST depression of 1 mm or more for at least 80 milliseconds, (2) ST elevation with convexity upwards of 1 mm or more, and (3) pain chest, giddiness along with the above ST displacements [17,18].

Patients and controls having single, or

multiple risk factors were then identified. Analysis of their stress tests were tabulated vis-a-vis the number of risk factors in each case to assess the degree of TMT positivity initially and to compare with subsequent TMT results during follow up.

All subjects were advised a prescribed cardiac diet, regular exercise schedule and were asked to avoid cigarette smoking, alcoholic over-indulgence as well as sudden severe physical exertion. Appropriate drugs were prescribed wherever indicated to treat the primary disease (CAD) or associated risk factors. Periodic follow up at six-monthly intervals was done in all with repeat clinical, biochemical, radiological and electrocardiographic tests as done on the initial evaluation. Stress test was repeated at each review and the result was compared with the earlier findings to ascertain progress. Each patient formed his own control for comparison of TMT results during the follow up period. Total number of positive TMT in each group was calculated initially and after every year for 4 years.

Results

All the 257 patients were males with ages varying between 25-59 years (mean age 42.56 years). Silent ischaemia was the commonest (104 cases) followed by non-Q-infarction (87 cases) and Q-infarction (66 cases). The mean age of controls was 41.82 years (Table 1). Analysis of the history (Tables 2 and 3), clinical examination and relevant biochemical tests (Table 4) revealed lack of exercise, dietetic indiscretion, cigarette smoking, over-indulgence in alcoholic drinks and a positive family history as the main risk factors in majority of cases. Clustering or multiplicity of risk factors (presence of 3 or more risk factors) was seen in 61.1% of the total studied; 51.9% in patients of silent ischaemia, 71.2% in Q-infarction and 64.4% in non-Q-infarction (Table 5). As many as 22 (8.5%) cases had no risk factor. Among the controls, 2 had positive family history, 3 were obese, 13 were chronic smokers, 26 had lack of exercise and 7 had dietetic indiscretion as risk

TABLE 1

Diagnosis and age distribution

Diagnosis	Total	Age in years			
		21-30	31-40	41-50	51-60
Controls	50	8 (16)	18 (36)	21 (42)	03 (6)
Silent ischaemia	104	15 (18.5)	36 (34.6)	43 (41.3)	10 (9.6)
Q-infarct	66	3 (4.6)	22 (33.3)	18 (27.3)	23 (34.8)
Non-Q-infarct	87	5 (5.6)	24 (27.7)	38 (43.8)	20 (22.9)
Total	257	23 (8.9)	82 (31.9)	99 (38.6)	53 (20.6)

(Percentages are given in parentheses)

TABLE 2

Risk factors : family history, smoking and alcohol

Diagnosis	Total	Positive family history	Cigarette smoking per day			Total	Alcoholic over-indulgence
			< 10	10-20	> 20		
Controls	50	2 (4)	5 (10)	4 (8)	4 (8)	13 (26)	5 (10)
Silent ischaemia	104	20 (19.4)	17 (16.3)	15 (14.4)	9 (8.6)	41 (39.3)	11 (10.6)
Q-infarct	66	9 (18.6)	9 (13.6)	12 (17.2)	7 (10.6)	28 (41.4)	15 (22.7)
Non-Q-infarct	87	13 (14.9)	8 (9.1)	14 (16.1)	13 (14.9)	35 (40.2)	18 (20.7)
Total	257	42 (16.3)	34 (13.2)	41 (15.9)	29 (11.3)	104 (40.4)	44 (17.1)

(Percentages are given in parentheses)

TABLE 3

Risk factors : diet and exercise

Diagnosis	Total	Dietetic indiscretion	Exercise			
			Regular	Irregular	None	Lack of Exercise (Total)
Controls	50	7 (14)	24 (48)	18 (36)	8 (16)	26 (52)
Silent ischaemia	104	48 (46.1)	35 (33.6)	33 (31.7)	36 (34.6)	69 (66.3)
Q-infarct	66	35 (53.1)	25 (37.9)	22 (33.3)	19 (28.8)	41 (62.1)
Non-Q-infarct	87	39 (44.8)	35 (40.2)	26 (29.9)	26 (29.9)	52 (59.8)
Total	257	122 (47.4)	95 (30.9)	81 (31.5)	81 (31.5)	162 (63.0)

(Percentages are given in parentheses)

TABLE 4

Risk factors : clinical and biochemical

Diagnosis	Total	Obesity	Hypertension	Diabetes mellitus	Hypercholesterolaemia
Controls	50	3	—	—	—
Silent ischaemia	104	31 (29.6)	5 (4.8)	11 (10.6)	19 (18.3)
Q-infarct	66	24 (36.4)	4 (6.1)	8 (12.2)	17 (25.7)
Non-Q-infarct	87	28 (32.2)	7 (8.1)	6 (6.9)	21 (24.1)
Total	257	83 (32.3)	16 (6.2)	25 (9.7)	57 (23.1)

(Percentages are given in parentheses)

TABLE 5

Multiplicity of risk factors

Diagnosis	Total	No of risk factors					Multiplicity of risk factors 2 3
		Nil	1	2	3	4	
Controls	50	21 (42)	17 (34)	5 (10)	7 (14)	—	7 (14)
Silent ischaemia	104	14 (13.5)	15 (14.4)	21 (20.2)	28 (26.9)	26 (25.0)	54 (51.9)
Q-infarct	66	3 (4.5)	7 (10.6)	9 (13.6)	22 (33.3)	25 (37.9)	47 (71.2)
Non-Q-infarct	87	5 (5.7)	11 (12.5)	15 (17.2)	25 (28.7)	31 (35.8)	56 (64.5)
Total	257	22 (8.5)	33 (12.3)	45 (17.5)	75 (29.2)	82 (31.9)	157 (61.1)

(Percentages are given in parentheses)

TABLE 6

Follow up study with repeat stress test evaluation

Diagnosis	Total	Stress test positivity					Rate of (%) improvement
		Initial	After 1 yr	After 2 yr	After 3 yr	After 4 yr	
Controls	50	—	—	—	—	—	—
Silent ischaemia	104	90 (86.5)	78 (75.5)	59 (56.7)	49 (47.1)	38 (36.5)	57.4
Q-infarct	66	54 (81.6)	47 (71.3)	43 (64.4)	39 (59.8)	37 (56.3)	31.5
Non-Q-infarct	87	70 (80.3)	59 (69.7)	50 (57.6)	45 (51.5)	41 (46.9)	41.5
Total	257	214 (83.3)	186 (72.4)	153 (59.5)	135 (52.5)	118 (45.9)	44.9

(Percentages are given in parentheses)

FOLLOW UP (STRESS TESTS RESULTS & RATE OF IMPROVEMENT)

Fig 1 : Stress test positivity (Lt side) and rate of improvement (Rt side) are shown in the three groups (see Table 6 for details)

factors. Seven (14%) of the controls had multiple risk factors whereas 21 (42%) had none. Initial stress test evaluations showed positivity in 86.5%, 81.6% and 80.3% of the silent ischaemia, Q-infarction and non-Q-infarction respectively. Stress test was repeated and results are given in Table 6. There was an overall improvement in all patients except 4 (1.56%) cases, 2 with silent ischaemia and one each with Q-infarction and non-Q-infarction, who had reinfarction during the 4-year period of follow up. No fatality was recorded during this period.

Repeat stress tests after 4 years showed positivity in significantly lesser number of patients in all groups - 36.5%, 56.3% and 46.9%, in silent ischaemia, Q-infarction, non-Q-infarction respectively (Table 6). This implies that 57.4%, 31.1% and 41.5% respectively of stress test positive patients had negative stress tests after 4 years. The subgroup with silent ischaemia showed maximum improvement in the 4-year follow up period.

Discussion

Coronary artery disease predominantly affects the middle-aged men with peak incidence around 50 years of age [15]. However, of late, younger people have been affected in increasing numbers [1-3] and occurrence of IHD between the ages of 25 to 30 years is not uncommon. In the present study, where only males were evaluated, 8.9% of patients were

below 30 years of age and 40.8% were below 40 years of age, apparently because of the fact that they belonged to the Armed Forces services where the age of retirement is less than in civil.

The main risk factors for IHD detected in this study were lack of physical exercise (63%), dietetic indiscretion (47.4%), smoking (40.4%), obesity (32.3%), hypercholesterolaemia (22.1%) and over-indulgence in alcohol (17.1%). Other risk factors like positive family history, diabetes mellitus and hypertension were seen less often in patients with IHD and the prevalences were 16.3%, 9.7% and 6.2% respectively. Lack of physical exercise, dietetic indiscretion and smoking are universally accepted major risk factors [3-6]. Several studies have shown that risk factors at high levels tend to cluster together and act synergistically to adversely affect the prognosis of coronary artery disease [8]. This has been amply illustrated in our study where multiple risk factors were found in 61.1% of the total studied (51.9%, 71.2% and 64.4% in the groups of silent ischaemia, Q-infarction and non-Q-infarction respectively). Strict therapeutic measures dealing with control or abolition of risk factors resulted in a significant drop in the positivity of stress tests after 4 years (45.9%) as compared to the initial evaluation (83.3%) of the total studied. This is also in agreement with several reports [3,6,7,12,16] which acknowledge the fact that control or abolition of risk factors leads to better prognosis in patient with IHD.

It was also evident that those groups who had high clustering of risk factors (Q-infarction 71.2%, non Q-infarction 64.4%) showed a less fall in positivity of stress tests as compared to the subgroup of silent ischaemia which had 51.9% cases with clustering of risk factors, again emphasizing that the presence of multiple risk factors led to higher morbidity in coronary artery disease [8,12,19]. The rate of improvement, therefore, had been maximum in subgroups of silent ischaemia (57.4%) with the least clustering of risk factors as compared to the other two

subgroups; 31.1% in Q-infarction and 41.5% in non-Q-infarction. The overall improvement rate was 44.9%.

As stated, the patients of IHD in this study had served as their own controls during the follow up. Ideally a group of age-matched IHD patients should have been followed up without attempting to control or abolish risk factors in them - so as to provide an universally acceptable control for comparison. All our subjects being service personnel, such a study would not have been possible due to existing service regulations and exigencies. Since this ideal control group could not be studied for comparison, the improvements achieved in stress test results after 4 years of control of risk factors lose some amount of significance. Nevertheless, enough evidence is available in current world literature, to prove that control or abolition of risk factors play a major role in overall improvement of IHD patients including their response to stress tests [6,20-25].

This study has unequivocally shown that principal risk factors like lack of physical exercise, dietetic indiscretion and smoking especially in combinations or clusters are found in alarmingly high percentages of IHD patients. It is therefore mandatory that efforts must be made to enforce control of these risk factors among service personnel especially those with IHD for greater overall improvement.

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