

Life Events as Risk Factors for Myocardial Infarction: A Pilot Case-control Study in Kolkata, India

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ABSTRACT

This case-control study was conducted in the Cardiology Department of Medical College, Kolkata, India, during 2000-2001, to explore the link between stressful life events and subsequent myocardial infarction (MI). One hundred consecutive confirmed MI patients were selected as a case group. One hundred age-, sex- and income-matched controls were selected from visitors other than relatives who attended these patients. The subjects were interviewed and asked to rate 61 life events with a number between 0 and 20. They also noted which of these they had experienced in the last one year. The main exposure variables included life events as per E.S. Paykel, smoking, alcohol consumption, chewing of tobacco, marital status, literacy, employment, and monthly per-capita income. The results showed that an MI patient was likely to experience 4.16 stressful life events, which were twice as much as the control group (2.24). The total stress score was the highest for serious personal illness followed by illness of family members and unemployment for the MI patients. For the controls, conflict between husband and wife, death of friends, and personal illness had the highest total stress score. The mean stress score for the MI patients was 35.5 compared to 17.35 among the controls. The MI subjects were more likely to have experienced stressful life events than the controls.

Key words: Myocardial infarction; Life events; Stress; Risk factors; Case-controlled studies; India

INTRODUCTION

Although coronary artery disease (CAD) is registering a downswing in its incidence in developed countries, it is assuming near-epidemic proportions in the Indian subcontinent (1). Myocardial infarction (MI) is one of the major causes of death in the world. Proportional mortality from diseases of the circulatory system is

45.6% in developed countries and 24.5% in developing countries (2).

Factors, such as hypertension, smoking, and elevated plasma cholesterol, have been studied as risk factors for CAD and MI. Psychosocial factors, such as anxiety and social isolation, have also been shown to contribute to cardiovascular-related morbidity and mortality (3).

Stressful life events, type 'A' behaviour, and prediction of cardiovascular-associated and total mortality over six years have been shown among 12,866 men participating in the multiple risk factor-intervention trial (4). Researchers have presented a life events and difficulties schedule (LEDS), with a perspective on psychodynamic aetiology, emphasizing the specificity of crucial

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links between life events and subsequent illness (5). The role of psychosocial stressors in the aetiology of acute MI has been studied (6).

Marital stress leads to a poor prognosis in women aged 30-65 years with coronary heart disease (CHD) (7). Increased risk of CHD for women in the lower occupational classes has been shown (8). Mental stress during daily life triggers myocardial ischaemia (9). The relevant link between stressful life events and mental disorders shows that the significance of life events is more important than the volume (10-12).

The impact of emotions on the heart has been shown conclusively in the West (13-15), but few studies have been conducted in developing countries to link stress with CHD. Hence, the present study was designed to show a correlation between stress and MI by life-event research in an Indian population.

MATERIALS AND METHODS

This pilot case-control study was conducted among 100 (86 males and 14 females) confirmed consecutive MI patients admitted to a teaching hospital (Medical College) in Kolkata, India, during June 2000–May 2001. One hundred controls were selected randomly from visitors other than relatives who visited these patients. They were matched for age, sex, and monthly per-capita income. Since this was a pilot study, the number of cases and controls was chosen ad hoc.

The main exposure variables included the following:

- a. Life events as per E.S. Paykel (16).
- b. Smoker was defined as a person smoking more than seven cigarettes per day for at least the last five years.
- c. Alcoholic was defined as a person consuming more than 200 mL of alcohol every day for more than one year.
- d. Tobacco chewer was taken as one chewing tobacco three times every day for more than one year.
- e. Marital status was categorized as currently married, or widowed, or single.
- f. A literate person was defined as one who could read and write any language.

g. Employment was categorized as unskilled work, skilled work, or professional.

h. Per-capita income of less than Rs 500 was considered as being low-, Rs 500-800 as middle-, and over Rs 800 as high-income groups (17).

Tools and techniques

Data were collected through a pre-designed and pre-tested schedule by interviewing patients and controls. Interview was conducted only after 72 hours of admission or when patients were clinically stable.

The 100 confirmed MI patients and 100 matched controls rated 61 life events presented on the E.S. Paykel scale (16,18) with local Bangla translation. The Bangla translation was validated by three experts in linguistics and cardiology, back-translated into English, and pre-tested with 20 MI patients. The respondents rated each event with a number between 0 (minimum stress) to 20 (maximum stress) to indicate how stressful in general is that event, not how stressful to them personally. They also noted which of these stressful events they experienced during the last one year.

Statistical analysis

The mean scores for each life event were arranged in descending order, separately for the case and the control group. The total stress score was calculated as the product of mean perceived stress and frequency of occurrence for each event. This was used for ranking the most important stressful events for both the groups. Spearman's rank correlation coefficient was calculated to compare with ranks in the control group.

The summation of the total stress scores for the MI patients was divided by 61 (the numbers of events) to find the mean stress score. The same procedure was followed for the control group. A *t*-test was done to examine the difference in the mean stress scores between the MI patients and the controls. Chi-square tests were also done to show the association between smoking and MI and also between alcohol consumption and MI. Alpha error was taken at 5% level everywhere, except for the chi-square test in Table 1.

The difference between the mean number of life events experienced by the MI patients and the controls was examined using a *t*-test, taking a normal approximation of study distributions and a one-sided *p* value.

RESULTS

Table 1 shows that only 8 patients and 10 controls were in the age group of 26-40 years. The rest were in the age groups of 41-55 and 56-70 years. Eighteen controls were female compared to 14 MI patients. Of the 100 MI patients, 87 were currently married, 5 widowed, and 8 were single. Of the 100 controls, 91 were married, 7 widowed, and 2 were single.

Table 1. Number (%) of patients and controls

Variable	Patients			Controls		
	Male	Female	Total	Male	Female	Total
Age (years) group						
26-40	7 (8.1)	1 (7.1)	8	8 (9.8)	2 (11.1)	10
41-55	36 (41.9)	9 (64.3)	45	35 (42.7)	11 (61.1)	46
56-70	43 (50.0)	4 (28.6)	47	39 (47.5)	5 (27.8)	44
Smoker	52 (60.5)	4 (28.6)	56	31 (37.8)	1 (5.6)	32*
Non-smoker	34 (39.5)	10 (71.4)	44	51 (62.2)	17 (94.4)	68
Alcoholic	10 (11.6)	4 (28.6)	14	1 (1.2)	0 (0.0)	1†
Non-alcoholic	76 (88.4)	10 (71.4)	86	81 (98.8)	18 (100.0)	99

* χ^2 (smoking)=11.69 with Yates' correction ($p<0.001$)
† χ^2 (alcohol consumption)=11.68 with Yates' correction ($p<0.05$)

Ten percent of the patients and 9% of the controls were illiterate. A comparatively higher percentage (31%) of MI was found among persons performing skilled and semi-skilled work. Moreover, 91% of the patients were of low socioeconomic status having a per-capita income of less than Rs 500 per month compared to 82% of the controls.

Fifty-six percent of the patients were smokers compared to 32% of the controls, and this difference was statistically significant ($\chi^2=11.69$ with Yates' correction, $p<0.001$). Fourteen percent of the patients were alcoholic, while only one person was alcoholic among the control group, and this difference was also statistically significant ($\chi^2=11.68$ with Yates' correction, $p<0.05$). No one admitted to taking drugs in either the patient or the control group. Thirty-four percent of the MI patients consumed betel leaf with tobacco, while 14% of the controls did the same. Fifty-five percent of the MI patients had hypertension and 16% had diabetes compared to 21% and 5% among the controls respectively.

Table 2 shows that the patients' perceptions of stressful events were serious personal illness (rank 5), financial loss/bankruptcy (rank 9), serious illness of family members (rank 15), remaining unemployed for one month despite being fit for work (rank 16), and marriage of

children against parent's will (rank 22), whereas among the control group, these ranks were 44, 2, 29, 28, and 46 respectively. Spearman's rank correlation coefficient (r_s) was 0.98, i.e. the ranks followed similar trends among patients as in the control group, although the ranks were consistently higher among the case group.

Table 3 shows the product of the mean stress value and actual frequency of occurrence in both MI patients

Table 2. Patients laid more stress than the control group on life events

Life event	Rank	
	Cases	Controls
Financial loss/bankruptcy	9	20
Serious personal illness	5	44
Serious illness of family members	15	29
Remaining unemployed for 1 month despite being fit for work	16	28
Marriage of children against will of parents	22	46
Spearman's rank correlation coefficient $r_s=0.98$		

and control group for 15 important life events. Serious personal illness had a product of >1,057 among the MI patients compared to about 55 among the controls. The highest product among the controls was for conflict between husband and wife (81.36) for which the patients had a product of <40. Another major life event for the MI patients was serious illness of family members for which the total score was 333.2 compared to 45.32 among the controls. Unemployment had a product above 300 among the MI patients, but 0 among the controls.

Seven MI patients had experienced substantial financial loss during the past year, while there was none in the control group with similar experience. Family members

Table 3. Life-event research of patients and controls

Sl. no.	Life event	Myocardial infarction patients			Controls		
		Frequency	Mean score	Total stress score	Frequency	Mean score	Total stress score
1	Death of child	0	19.13	0	1	19.33	19.33
2	Death of spouse	2	19.67	39.34	1	18.20	18.20
3	Death of family members	4	16.63	66.52	1	16.70	16.70
4	Death of friends	17	11.63	197.71	6	12.10	72.60
5	Financial loss/bankruptcy	7	12.77	89.39	0	12.93	0
6	Serious illness of family members	28	11.90	333.20	4	11.33	45.32
7	Unemployment	27	11.67	315.09	0	11.37	0
8	Serious personal illness	68	15.46	1,057.28	6	9.13	54.78
9	Huge loan	15	6.83	102.45	3	9.20	27.6
10	Retirement	10	8.77	87.70	3	9.30	27.9
11	Marriage	0	15.30	0	1	14.73	14.73
12	Birth of baby/adoption	0	8.50	0	1	14.63	14.63
13	Engagement or marriage of son/daughter	3	8.93	26.49	3	12.77	30.31
14	Minor violation of law	11	3.40	37.40	12	3.80	45.6
15	Conflict between husband and wife	9	4.33	39.97	8	10.17	81.36

of 28 MI patients suffered from a serious illness during the past year, whereas only four controls reported a similar incidence. Twenty-seven MI patients were unemployed for one month despite being fit for work, but none among the controls had a similar experience. Sixty-eight MI patients suffered from serious personal illness compared to six among the controls. Fifteen MI patients took huge loans amounting to more than half of their annual income, whereas only three controls were compelled to do the same.

The MI patients experienced an average of 4.16 life events during the past year compared to 2.24 among the controls. This difference was statistically significant ($t=12.4$, $p<0.001$).

The mean stress score for each MI patient was 35.3, whereas it was only 17.35 for each control, and this difference was also statistically significant ($t=14.21$, $p<0.001$).

DISCUSSION

Epidemics of CHD began at different times in different countries. In the United States, the epidemic started in the early 1920s, in Britain in the 1930s (19), and in several European countries thereafter. Epidemics have now commenced in developing countries, and countries where an epidemic began earlier are now showing a decline.

This hospital-based case-control study has shown that MI occurred more frequently among males and in older (40 years and above) age groups. The majority (56%) of the patients were regular smokers. More alcoholics were found among the patients than among the controls. Statistical control for age and gender differences was not done, although lack of age and gender differences between the patients and the controls make it unlikely that their effect would be significant.

When CHD emerged as a modern epidemic, it was the disease of higher social classes in most affluent societies, but recently there is a strong inverse relationship between social class and CHD in developed countries (19). A similar finding was also observed in our present study where most (91%) patients were of low socioeconomic status (per-capita income of less than Rs 500 per month) based on the modified Kuppaswamy scale (17).

It was observed in the present study that the control individuals were likely to have experienced an average of two (2.24) stressful life events during the past year without suffering from any adverse physical or psychological disturbance, whereas an MI patient is likely to have experienced an average of four (4.16) stressful life events during the past year.

The above findings corroborated the findings of Singh and colleagues who found that individuals in our

society are likely to experience two stressful life events during the past year and 10 events in a life time without suffering from any adverse physical or psychological disturbances (20). The occurrence of major life events signals a period of increased risk when supportive interventions may prevent illness (21). Frasure-Smith has shown that depression after MI can raise the likelihood of subsequent mortality (22).

Geyer and others have compared data from three life-event studies among depressives, MI patients, and industrial workers (23). They showed that the number of events and severity ratings were positively correlated with measures of depression.

Indeed, there should be a social support network to prevent depression due to experiences of extreme and negative life events from leading to psychosomatic problems, including MI (24). Assessment of mental health and timely counselling by trained personnel in this field may be useful tools to enhance mental functioning before the development of such illnesses.

The limitations of the study include an inadequate sample size and a cross-sectional design that allows conclusions about association rather than causes.

The link between stress and MI should be confirmed through longitudinal studies, making adjustments for bias and confounders. Then, coping with stress would have important public-health implications for health-care providers and policy-makers.

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