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Perceived Stress and it's Relationship with Recent Myocardial Infarction (MI): A Hospital based Case Control Study.

Dr Silvi Batham[1], Dr AR Deshpande[2], Dr Shashank Raikwar[3*].

[1]Assistant Professor, Department of Community Medicine, NMCRC, Kanpur, Uttarpradesh.
[2]Professor, Department of Community Medicine, SAIMS, Indore, Madhyapradesh.
[3]Associate Professor, Department of Psychiatry, NMCRC, Kanpur, Uttarpradesh.

Correspondence:
Dr Shashank Raikwar
Associate Professor, Department of Psychiatry, NMCRC, Kanpur, Uttar Pradesh.
Email:
drpsychiatry@outlook.com

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Abstract

Background: ***Aim:*** To study perceived stress in patients of Myocardial Infarction (MI) (cases) and controls. in admitted patients of a tertiary care center. **Study Design*:*** Current study is hospital based (tertiary care center), case control study. ***Period of Study:*** The period of study was from December 2018 to June 2020 i.e.18 months. Collection of data: one year from December 2018 to December 2019. ***Results:*** Perceived stress was noted in moderate range in 90 (72 %) cases and in 53 (42.4 %) controls. However, most of controls reported stress in mild range i.e. 63 (50.4 %). A high statistical significance of perceived stress was observed with MI. ***Discussion /Conclusion:*** After application of statistical tools, logistic model for prediction of risk of MI between cases and control, in the current study, showed that perceived stress scale score (p=0.002) was found to be the highly/strongly significant predictor.

Keywords: Myocardial Infarction, Perceived Stress, case control.

INTRODUCTION

Studies have revealed that work-related stress or socially isolated or loneliness have an increased risk of a first MI event and short-term emotional stress can trigger cardiac events in advanced atherosclerosis [1]. Stress is defined as the body's nonspecific response to physical/ psychological demands made on it, or to disturbing environmental events [2].

The relationship between psychosocial stressors and disease is complex and is affected by the nature & persistence of the stressors. It is also closely related to the individual's biological vulnerability (i.e., genetics, constitutional environmental factors), psychosocial resources which he/she possesses, and learned patterns of coping [3]. The INTERHEART study is the largest study, in which the relationship between long-term stress and MI has been examined along with other potentially modifiable risk factors [4].

Chronic stress is believed to contribute to both the development and progression of cardiovascular disease and cardiovascular death [5]. The mechanisms underlying this association are complex and include a combination of behavioral (e.g., smoking, lack of exercise, obesity, medication non-adherence) and physiological factors (e.g., increased blood pressure and pulse rates, reduced insulin sensitivity, increased platelet aggregation, endothelial dysfunction [5]. Although psychological factors play an important role in MI, their affiliation with MI is an complex issue.

With the above information, we felt that there are few structured studies on stress and especially as a prominent modifiable risk factor in pathogenesis of MI. so this study was conducted to assess the effect of Perceived stress in the background of presence of other risk factors and independently also.

MATERIALS AND METHODS

Study Design: Current study is hospital based (tertiary care center),case control study.
Period of Study: The period of study was from December 2018 to June 2020 i.e.18 months. Collection of data :one year from December 2018 to December 2019.

Sample size: Patients admitted with MI in year 2019 in cardiology ward, with age matched controls admitted in same hospital. A sample of 125 cases and 125 controls i.e. 250 (cases and controls) were taken. Although a initial sample size of 300 patients (150 cases and 150 controls) was planned during initial phase of study (visualizing trends of previous years), but after implementing exclusion criteria only 125 patients were found fit to be included in study. The controls were matched to cases for age group, sex and even socio-economic status.

Sampling Frame: All patients diagnosed as MI (including both newly diagnosed cases and cases who have suffered MI in past), admitted under department of Cardiology during study period, and fulfilling inclusion criteria were included in the study.

Inclusion Criteria: Admitted patient with MI following acute management/ stabilization (cases).
1. Admitted patient of other diseases (control).
2. He/ She must give consent to participate in the study.
3. He/ She must be above the age of 18 years.
4. He/ She should not have been hospitalized for cardiac event earlier (for controls).

Exclusion Criteria:
1. Patient not giving consent.
2. Patients with poor general condition – needing him/ her to stay in Intensive care unit.
3. Patients with psychiatric illness in past.

Data Collection: Study started after acquiring the permission from institutional research and ethical committee of SAMC and PGI Indore. Subsequently a written permission was sought from Head of Department of Cardiology for the present study to be conducted in cardiology ward, following stabilization of MI patients. However complete study was conducted under guidance and direct supervision of Department of Community Medicine.

According to European Society of Cardiology guidelines 2017, It is considered safe to shift patient or discharge patients with MI after 02-03 days after admission and therapy to a lower center [6]. Hence in this study we included patients only after 72 hours of hospitalization or 24 hours after shifting in ward from intensive care unit, whichever was later. The chosen timing also ensured that at least one of relatives/ caregiver was present with patient. The predesigned proforma was used to collect information about epidemiological factors. Perceived stress scale [7]. The application of perceived stress scale was learned with the help of department of psychiatry and it was conducted in following manner.

Instruction to Patients:
This is a questionnaire in which you will be asked how you feel and think in a certain way, during past one month. You may feel that the questions are similar but there are differences between them and you must treat each question separately. Please don't try to count the number of times you felt in a particular way but have a reasonable estimate and answer. A fine approach would be to answer questions as quick as possible.

Scoring:
The PSS-10 questions are scored from 0-4. However, scores are reversed for questions 4,5,7, and 8. For these questions the scores are changed as 0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0. Subsequently all scores are added up to get a total score.

Table 6: Interpretation of PSS 10 [7]

Score	Interpretation
0-13	Low perceived stress
14-26	Moderate perceived stress
27-40	High perceived stress

RESULTS

Table No. 1 Distribution of patients according to PSS

Scores in PSS	Cases (%)	Controls (%)	Total (%)
Mild (0-13)	27 (21.6 %)	63 (50.4 %)	100 (40 %)
Moderate (14-26)	90 (72 %)	53(42.4 %)	143 (57.2 %)
Severe (27-40)	08 (6.4 %)	09 (7.2 %)	17 (6.8 %)
Total	125 (50 %)	125 (50 %)	250 (100 %)

(Pearson Chi Square = 24.032, df=2, p <0.0001; statistically significant)
Perceived stress was noted in moderate range in 90 (72 %) cases and in 53 (42.4 %) controls. Severe stress was minimally reported, ranging from 6.4% of cases and 7.2% controls. However, most of controls reported stress in mild range i.e. 63 (50.4 %). A high statistical significance of perceived stress was observed with MI.

Prediction of the risk of MI among studied population of cases and controls
Relationship between the existences of risk of MI between cases and controls and selected clinico-demographic variables was investigated by using binary logistic regression wherever the risk of MI(case/control) used as dependent variable after controlling for origin, education, occupation, family type, past histories of MI/ stroke/ hypertension/ diabetes, past history of cerebro vascular disease (CVD), family history of MI, salt intake, oil intake, physical activity, tobacco use, alcohol use, body mass index, and perceived stress scale score of studied cases and controls in univariate analysis.
Difference of risk of MI between the cases and controls was analyzed using a binary univariate logistic regression model to determine the significant risk factors for risk of MI.

At first step, the existence of risk of MI between cases and controls (dependent variable) was analyzed using univariate analysis of selected continuous and non-continuous predictors (independent variables). Bivariate logistic regression used to predict the risk of MI in cases and controls by employing individually each of the selected continuous and non-continuous predictors (origin, education, occupation, family type, past histories of MI/ stroke/ hypertension/ diabetes, past history of cerebro vascular disease, family history of MI, salt intake, oil intake, physical activity, tobacco use, alcohol use, body mass index, and perceived stress scale score).

The second step involved all the significant variables from a previous step were entered in a bivariate logistic regression (forward-Wald) model to determine the independent risk factors for risk of MI. Post univariate analysis, the bivariate logistic regression employed again to predict the risk of MI (dependent variable) among patients by employing selected continuous and non-continuous predictors (independent variables) that were found to be significant in univariate analysis.

Overall, the difference in risk of MI among subjects(case/control) was analysed and compared using a bivariate logistic regression model in order to determine the significance of the predictors in predictingrisk of MI. The adjusted odds ratio with 95% confidence interval was estimated. Nevertheless, the sensitivity and specificity of prediction was also calculated.

Table numbers 2 and 3 summarizes the bivariate logistic regression used to model the prediction of risk of MI among studied subjects(case/control).

Table 2:-Univariate analysis for the assessment of significance of predictors of MIamong studied population(cases/controls)

Predictors with parameter		B	Std. Error	p-value (LOS)	Odds Ratio	95% CI	
						Upper	Lower
Origin	**Urban**	-0.42	0.256	p=0.099 ^	0.66	0.40	1.08
Family Type	**Joint**	-0.045	0.448	p=0.157 ⊗	0.96	0.40	2.30
	Nuclear	-0.506	0.269	p=0.061 ^	0.60	0.36	1.02
Occupation	**Managerial**	-21.07	28420.72	p=0.999 ⊗	0.00	0.00	-
	Professional	0.312	.485	p=0.520 ⊗	1.37	0.53	3.54
	Semi-Skilled	0.823	1.246	p=0.509 ⊗	2.28	0.20	26.18
	Unemployed	0.246	.292	p=0.400 ⊗	1.28	0.72	2.27
Education	**Illiterate**	.859	.762	p=0.260 ⊗	2.36	0.53	10.51
	Primary	.125	.795	p=0.875 ⊗	1.13	0.24	5.38
	Secondary	.685	.788	p=0.385 ⊗	1.98	0.42	9.30

	Higher Secondary	.069	.790	p=0.930 ⊗	1.07	0.23	5.04
	Graduate	.859	.762	p=0.476 ⊗	1.83	0.35	9.72
Salt intake	**<5-≤10 gm**	-1.134	.852	p=0.183 ⊗	0.32	0.06	1.71
	>10 gm	-.588	.865	p=0.497 ⊗	0.56	0.10	3.03
Past History of MI (No)		-21.25	16408.74	p=0.999 ⊗	0.00	0.00	-
Hypertension (Yes)		-0.569	0.26	p=0.029 *	0.57	0.34	0.94
Diabetes (No)		-0.776	0.292	p=0.008 #	0.46	0.26	0.82
Predictors with parameter		**B**	**Std. Error**	**p-value (LOS)**	**Odds Ratio**	**95% Upper**	**CI Lower**
Past History of Stroke (No)		-21.28	23205.47	p=0.999 ⊗	0.00	0.00	-
Past History of CVD (No)		-0.922	0.261	p=0.000 #	0.40	0.24	0.66
Family History MI (No)		-0.597	0.285	p=0.036 *	0.55	0.32	0.96
Oil intake	**>15-25 gm**	-1.279	0.657	p=0.052 *	0.28	0.08	1.01
	>25 gm	0.061	0.655	p=0.926 ⊗	1.06	0.30	3.84
Physical Activity (Yes)		-1.656	0.295	p=0.000 #	0.19	0.11	0.34
Body Mass Index		-0.002	0.040	p=0.969 ⊗	0.99	0.92	1.08
Perceived Scale Score		0.63	0.21	p=0.002 #	1.07	1.02	1.11
Tobacco Use	**Non Tobacco**	-2.986	0.423	p=0.000 #	0.05	0.02	0.12
	Smokeless Tobacco	-1.480	0.389	p=0.000 #	0.23	0.11	0.49
Alcohol use	**Lifetime abstainer**	-0.312	0.300	p=0.298 ⊗	0.73	0.41	1.32

The test variable is highly significant at the 0.000 levels of significance.

* The test variable is significant at the 0.000 levels of significance.

⊗ The test variable isn't (Insignificant) significant at the 0.05 level of significance.

[LOS-Level of Significance; Std. Error-Standard Error; CI-Confidence Interval]

Table 2 reports the assessment of univariate analysis to model the prediction of individual risk factors of risk of MI (dependent variable) between cases and controls.

Outcome of bivariate logistic regression used to predict the risk of MI (dependent variable)between cases and controls by employing selected each of the continuous and non-continuous predictors such as origin, education, occupation, family type, past histories of MI/ stroke/ hypertension/ diabetes, past history of cerebro vascular disease, family history of MI, salt intake, oil intake, physical activity, tobacco use, alcohol use, body mass index, and perceived stress scale score in a univariate analysis.

The difference between cases and controls for the risk of MI were analysed and compared using a bivariate logistic regression model to determine the significant continuous and non-continuous predictors (independent variables)of risk of MI.

Bivariate logistic regression (Enter-Wald) analysis performed in each subject group (case/control) to determine the independent indicators of risk of MIamong studied patients.

Logistic model for prediction of risk of MI between cases and controlshowed that the past history of cerebro vascular disease (p=0.000), presence of diabetes (p=0.008), tobacco use (p=0.000), physical in activity (p=0.000) and perceived stress scale score (p=0.002) were found to be the highly/strongly significant predictors of the risk of MI between cases and controls in univariate analysis. However, the hypertension (p=0.029), family history of myocardial infraction (p=0.036) and oil intake (p=0.052) were the significant predictors of the risk of MI between cases and controls. No significant relation between the quantity of salt intake could be established in current study.

But, the origin (p=0.09) and type of family (p=0.061) were found to be the poorly significant predictors at 91.0% and 93.9% confidence intervals respectively of the risk of MI between cases and controls in univariate analysis.

Further, it was noted that occupation (p>0.05), education (p>0.05), past history of MI (p>0.05), past history of stroke (p>0.05), body mass index (p>0.05) and alcohol use (p>0.05) were not the significant predictors of the risk of MI between cases and control in univariate analysis.

Table 3:-Significance of predictors of MIamong studied population(cases/controls)

Predictors with parameter		β	Std. Error	p-value (LOS)	Odds Ratio	95% CI	
						Upper	Lower
Hypertension (Yes)		0.345	0.624	p=0.029 *	1.41	0.42	4.79
Diabetes (No)		-0.425	0.557	p=0.008 #	0.65	0.22	1.95
Past History of CVD (No)		-1.565	0.737	p=0.000 #	0.21	0.05	0.89
Family History MI (No)		-0.493	0.414	p=0.036 *	0.61	0.27	1.38
Physical Activity (Yes)		-2.273	0.427	p=0.000 #	0.10	0.05	0.24
Tobacco Use	**Non Tobacco**	-3.679	0.561	p=0.000 #	0.03	0.01	0.08
	Smokeless Tobacco	-1.796	0.485	p=0.000 #	0.17	0.06	0.43
Perceived Scale Score		0.111	0.031	p=0.002 #	1.12	1.05	1.19
Oil intake	**>15-25 gm**	-0.312	1.028	p=0.052 *	0.73	0.10	5.49
	>25 gm	-1.323	0.381	p=0.926 ⊗	0.27	0.13	0.56
Constant		2.794	0.803	p=0.001 #			

The test variable is highly significant at the 0.000 levels of significance.

* The test variable is significant at the 0.000 levels of significance.

⊗ The test variable isn't (Insignificant) significant at the 0.05 level of significance.

[LOS-Level of Significance; Std. Error-Standard Error; CI-Confidence Interval]

Table 3 reports the final model utilized to measure the significance of associated risk factors used to predict the risk of MI (dependent variable) between cases and controls.

Post univariate analysis, the bivariate logistic regression employed again to predict the risk of MI (dependent variable) between cases and controls by employing selected continuous and non-continuous predictors (independent variables) that were found to be significant in univariate analysis. However, the hypertension, diabetes, family history of MI, past history of cerebro vascular disease (CVD), oil intake, physical activity, tobacco use and perceived stress scale score were the significant predictors of the risk of MI between cases and controls in univariate analysis.

Binary logistic regression is used to predict the risk of MI between cases and controls and the associated risk factors found to be significant in the univariate analysis were used to model the prediction of risk of MI among studied cases and controls. The second step involved all the significant variables from a previous step were entered in a multivariate logistic regression (forward-Wald) model to determine the independent risk factors for risk of MI between cases and controls. Nevertheless, the bivariate logistic regression used to predict the risk of MI between cases and controls (dependent variable) by employing significant continuous and non-continuous predictors from a previous step.

The difference between cases and controls for the risk of MI were analysed and compared using a bivariate logistic regression model to determine the significant continuous and non-continuous predictors (independent variables) of risk of MI. However, the bivariate logistic regression (Enter-Wald) analysis performed in each subject group (case/control) to determine the independent indicators of risk of MI among studied patients.

Logistic model for prediction of risk of MI between cases and control showed that the non modifiable risk factors such as past history of diabetes (p=0.008), past history of cerebro vascular disease (CVD) (p=0.000), past history of hypertension (p=0.029), family history of myocardial infraction (p=0.036) were significantly associated with MI.

Modifiable risk factors like physical activity (p=0.000), non use of tobacco (p=0.000) along with smokeless form, oil intake between 15-25 gm/day (p=0.052) and perceived stress scale score (p=0.002) found to be the highly/strongly significant predictors of the risk of MI between cases and controls.

The adjusted odds for hypertension (1.41) found to be higher as compared to odds for perceived stress scale (1.12) score among the patient while odds for rest other variables found to be less than one. The probability of correct prediction by

model found to be 80.8%. However, the sensitivity of prediction (case)found to be 80.0% as compared to specificity of prediction (control)was 80.8%. The individual full logistic regression model for risk assessment of MI (case/control) is as follows.

Log odds of risk of MI = 2.794 + 0.345 × Hypertension (1, If No and 0, If Yes)- 0.425 × Diabetes (1, If No and 0, If Yes) – 1.565 x Past History of CVD (1, If No and 0, If Yes) - 0.493 x Family history of MI (1, If No and 0, If Yes) – 2.273 x Physical activity (1, If Yes and 0, If No) – 3.679 x Tobacco use (1, If Non-Tobacco user and 0, If No)- 1.796 x Tobacco use (1, If Smokeless Tobacco user and 0, If No)+ 0.111 × Perceived Scale Score- 0.312 × Oil intake (1, If >15-25 gram and 0, If No)– 1.323 × Oil intake (1, If >25 gram and 0, If No).

DISCUSSION

In a prospective cohort study in Finland over 24,000 individuals, Herman Nabi et al. found that high perceived stress was associated with a significantly increased incidence of coronary heart disease events, including MI, even after adjusting for conventional risk factors [8]. This suggests that stress independently contributes to cardiovascular risk [8]. The INTERHEART study revealed that a multiple psychological risk factors like social deprivation, depression, stress in work or family life were found to be associated with increased risk of MI with relative risk of 2.3 for males and 3.5 for females [4]. The population attributable risk was reported to be 25 % in males and 40 % in females [4].

In a study conducted on patients of MI by Arnold SV et. al, (n=4204), 1622 (38.6 %) were found to have moderate or high level of perceived stress (on PSS), four weeks preceding MI [5].

In a case control study conducted out by Zodpey. al, in 2013 [8] on evaluation of risk factors for acute MI in central India, the moderate to severe stress in past 01 year was found in 38 cases and 19 controls with odds ratio of 2.59 with confidence interval 1.38-4.95 [9]. In the same study mild stress was found in 84 cases and 61 controls with odds ratio of 1.78 with confidence interval 1.18-2.70 [9]. In another case control study conducted by Bahall et. al, from Mar 2011 to Apr 2012, upon 251 AMI hospitalized patients against 464 age and sex matched controls multivariate logistic regression revealed odds ratio of stressful life to be 2.697 with p value of ≤ 0.001 [95% CI for OR (1.585, 4.587)] [10].
All the studies including this study identified psychological stress to be an important and significant risk factor for MI.

CONCLUSION

Our study was in line with previous studies, perceived stress has been shown to independently increase the risk of myocardial infarction and adversely affect long-term outcomes, underscoring its role as a significant psychosocial determinant of MI. the stress is a measurable variable, which can be tested and prognosticated. Psychologist and psychiatrist can potentially modify these risk factors. Timely intervention can limit severity and outcome of MI.

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