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Association of Perceived Stress with Acute Coronary Syndrome: A Matched Case Control Study

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ABSTRACT

Background

Acute Coronary Syndrome (ACS), a leading cause of morbidity and mortality globally. While traditional risk factors for ACS are well studied, the role of perceived stress remains underexplored in our context. Hence, we aimed to find the association of perceived Stress with Acute Coronary Syndrome.

Methods

A hospital based case control study, matched with age and gender was conducted at Birat medical College teaching Hospital from 1st July to 28th November2023. Consecutive sampling techniques was employed to enroll 50 cases and 50 controls from the hospital. Data on demographics and risk factors were collected, and the Perceived Stress Scale-10 (PSS-10) was used to measure stress in both groups. Multivariate logistic regression analysis was conducted to determine the independent association of PSS-10 with ACS.

Results

Perceived stress had no statistical significant association with ACS (P=0.069, OR= 0.918, CI 0.837-1.007) when adjusting for other risk factors. However, hypertension (P=0.004, OR=4.59, CI=1.61-13.09), smoking (P=0.004, OR=8.48, CI=2.09-34.38), and a family history of cardiovascular disease (P=0.028, OR=4.97, CI=1.19-20.75) showed statistically significant associations with ACS, while controlling for other factors.

Conclusions

The study found higher perceived stress in ACS patients, but it wasn't an independent predictor of ACS. Significant associations with hypertension, smoking, and family history emphasize the need for comprehensive risk factor management in preventing cardiovascular disease.

Keywords: acute coronary syndrome; cardiovascular disease; perceived stress; risk factor.

INTRODUCTION

Cardiovascular diseases, accounting for 32% of global deaths, are the leading cause of mortality, with Acute Coronary Syndrome (ACS) responsible for nearly half of ischemic heart disease deaths.[1,2] In Nepal, the prevalence of ACS ranges from 14.5% to 33.93%.[3,4] While traditional risk factors like hypertension, hyperlipidemia, and smoking are well-studied, the role of psychological factors, especially perceived stress, in ACS pathogenesis is gaining attention.[5-7] Perceived stress activate the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system, potentially triggering adverse cardiac events.8 Despite biological plausibility and epidemiological evidence linking stress to cardiovascular outcomes, the independent association between perceived stress and ACS is underexplored, particularly in our context. Identifying individuals at higher risk due to elevated stress could enable targeted prevention strategies, reducing ACS incidence and burden. This study aims to investigate the independent association between perceived stress and ACS using a matched case-control design.

METHODS

We conducted a hospital based case control study matched with age(within ± 2 years) and sex at Birat

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Medical College Teaching Hospital from1st July to 28th November2023. Ethical approval was obtained from the institutional review board of the same institute. Each participant was informed about the purpose of the study and voluntary informed consent was obtained prior to data collection. Sample size was calculated using formula for matched case control study for quantitative variable using formula:

$$n = \frac{2(Z_{\beta}+Z_{\alpha/2})^2 * \sigma^2}{\delta^2}$$

Where,

n = sample size in each group (cases and controls)

Z α/2 = Standard normal variate for level of significance (at 5% type 1 error ($p<0.05$) 1.96

$Z\ \beta$ = standard normal variate for power=for 80% power it is 0.84

σ = standard deviation

δ = minimum clinically significant difference (the effect size you want to detect)

Using reference of an article,9 Where σ=6.84, δ=4.17 , $Z\ \beta$=0.85, Z α/2=1.96,

$$n = \frac{2(0.85+1.96)^2\ (6.84)^2}{(4.17)^2}$$

$= (15.79 \text{ X } 46.79)/17.38 = 42.48$

n = 42.48

Meanwhile we took a total of 100 samples (50 samples in each case and the control group). We enrolled confirmed diagnosed cases of acute coronary syndrome consecutively from the department of cardiology of Birat Medical College Teaching Hospital. Patients diagnosed with any clinical presentation: Unstable angina, Non ST segment elevation myocardial infarction (NSTEMI) and ST segment elevation myocardial infarction (STEMI)} were defined as acute coronary syndrome(ACS). Then fifty individuals without previous or present history of ACS and other heart diseases matched with age(±2) and sex were purposively selected from the same setting after completing case group selection. Patients diagnosed with stable angina, any other cardiac diseases (congestive cardiac failure, rheumatic Heart disease etc), chronic neoplastic disease or chronic inflammatory disease, cognitive impairment, current or past history of psychiatric illness, major diseases (AIDS, cancer, chronic obstructive pulmonary disease), those on antipsychotic medications and refusal to consent were excluded from the study. We collected data by means of face to face interview technique. We used a structured questionnaire to collect data on socio demographic variables and known risk factors for ACS. Then the perceived stress scale (PSS-10) was used to measure stress level of each case and control. The total time required for each participant was on average 15 minutes. The PSS scale developed by Cohen, Kamarck and Mermelstein in 1983 is one of the most widely used measures for assessing perceived stress. It measures the degree to which participants perceive unpredictability, lack of control, or overload in their lives.10 PSS-10 is the further abbreviated version from the original PSS including 14 items (PSS-14). Participants's responses to their feelings and thoughts about life events and situations over the previous month are rated on a five-point scale ranging from 0- Never, 1-almost never, 2-sometimes, 3-fairly often (4) Very Often. Total scores range from 0 to 40 with higher scores indicating higher levels of perceived stress. The internal consistency reliability of PSS-10 was 0.87.11 The tool was translated in Nepali and Maithili language and retranslated in English language for ensuring content validity. Reliability of the retranslated tool was assessed by calculating the cronbach's alpha which was >0.7. We entered collected data in the microsoft excel sheet, editing and coding was done and transferred to IBM SPSS version 23. At first we performed bivariate analysis to find the statistical significant association of a patient's personal history which includes marriage, ethnicity and known risk factors(hypertension, smoking, dyslipidemia, diabetes, family history of heart disease) and PSS scale with outcome variable ACS. Chi square test was used to calculate the association between ACS with known risk factors and demographic profiles. For finding the association of ACS with PSS -10, an independent t test was applied. P value <0.05 at 95% confidence interval was considered statistically significant. The results obtained from bivariate

analysis were further analyzed by multivariate analysis using logistic regression in order to adjust and explore the significance of explanatory variables. Cases of ACS were considered dependent variables. The independent variables which had p value<0.05 in the bivariate analysis were considered for multivariate analysis. The enter method was used to determine the important confounding variables. Adjusted odds ratio and confidence interval was calculated.

RESULTS

We included 100 participants in our study, with 50 cases and 50 controls matched by age and sex. The mean PSS score was higher in cases compared to controls (16.240 ± 6.029 vs. 13.44 ± 5.614). Known risk factors such as hypertension (66% vs. 22%), smoking (38% vs. 8%), dyslipidemia (36% vs. 16%), diabetes (60% vs. 22%), and a family history of cardiovascular disease (28% vs. 8%) were more prevalent in cases than in controls. ACS showed a statistically significant association with PSS-10 score, hypertension, smoking, dyslipidemia, diabetes, and family history of cardiovascular disease (P < 0.05) (Table 1).

Perceived stress had no statistical significant association with ACS (P=0.069, OR= 0.918, CI 0.837-1.007) while adjusting with other risk factors. Hypertension(P=0.004, OR=4.59, CI =1.61-13.09), smoking(P=0.004, OR= 8.48, CI= 2.09-34.38) and family history of cardiovascular disease(P= 0.028, OR=4.97, CI=1.19-20.75) were significantly associated with the occurrence of ACS after adjusting for other factors (Table 2).

Table 1. Demographic history lifestyle and Perceived stress in cases and control. (n=100)

Characteristics	Cases n(%)	Control n(%)	p-value
Age	59.74±11.34	59.63±11.33	Age range (27-81 years) Matched
Gender			
Males	38(50)	38(50)	
Females	12(50)	12(50)	
Ethnicity			
Madhesi	21(42)	16(32)	0.186
Brahmin chhetri	7(14)	16(32)	
Janajati	7(14)	8(16)	
Muslim	9(18)	4(8)	
Dalit	6(12)	6(12)	
Marital status			
Married	45(90)	49(98)	0.207**
widower, divorced, unmarried	5(10)	1(2)	
Total working hours			
Less than 8 hours	16(32)	24(48)	0.153***
≥ 8 hours	34(68)	26(52)	
Hypertension			
Yes	33(66)	11(22)	<0.001
No	17(34)	39(78)	
Smoking			
Yes	19(38)	4(8)	0.001
No	31(62)	46(92)	
Dyslipidemia			
Yes	18(36)	8(16)	0.04
No	32(64)	42(84)	
Diabetes			
Yes	30(60)	11(22)	<0.001
No	20(40)	39(78)	
Family history of cardiovascular disease			
Yes	14(28)	4(8)	0.019
No	36(72)	46(92)	
PSS score	16.240±6.029	13.440±5.614	0.018[a]

* Pearson Chi-Square, ** Fisher's Exact Test, *** continuity correction chi square test [a]Independent sample t test was used.

Table 2. Logistic regression analysis examining the association of various risk factors with acute coronary syndrome (ACS) in cases (n=50) and controls (n=50).

Risk factors	p-value**	Adjusted Odds Ratio exp(β)	95% Confidence interval (CI)
Hypertension (Y/N)	0.004	4.592	1.61-13.095
Smoking(Y/N)	0.004	8.48	2.091-34.38
Dyslipidemia(Y/N)	0.435	1.689	0.453-6.298
Diabetes(Y/N)	0.098	2.453	0.847-7.101
Family history of heart disease (Y/N)	0.028	4.977	1.194-20.746
PSS score	0.069	0.918	0.837-1.007

Y/N= Yes/No

** p-value <0.05 at 95% confidence interval was considered statistically significant

DISCUSSION

This study aimed to investigate the association of perceived stress with Acute Coronary Syndrome (ACS) in a matched case-control design. Our findings revealed that the mean Perceived Stress Scale (PSS) score was higher in ACS cases compared to controls, although perceived stress was not independently associated with ACS when adjusted for other risk factors. Notably, hypertension, smoking, and family history of cardiovascular disease were significantly associated with the occurrence of ACS. The higher mean PSS score observed in ACS (cases=16.240± 6.029 vs. controls =13.44±5.614) in our study aligns

±

with previous research indicating elevated stress levels in individuals with cardiovascular conditions (19.47± 7.08 vs. 15.3± 6.6 and 29.6±8.2 vs 19.8±7.8 respectively).[9,12] However, after adjusting other known risk factors, our findings stated that perceived stress was not a statistically significant independent risk factor for ACS. This contrasts with some studies suggesting a direct link between stress and cardiovascular events.5,7,12 For instance, Rosengren et al. (2004) found that psychosocial stress was a significant predictor of myocardial infarction in the INTERHEART study.13 Similarly a study from Iran also reported a 1.38% risk (CI:1.056-1.808), P = 0.019] for developing coronary heart disease (CHD) and a pooled estimate of 1.455% risk (CI:1.088-1.944), P < 0.011] for mortality due to perceived stress, which contrasts with our findings.14 However, a study by Anchal Agrawal et al. from Gujarat, India, found contrasting results, indicating that healthy individuals had a higher level of perceived stress (25%) compared to cardiac patients (18.7%). This difference may be due to differences in stress perception or reporting among the populations studied.15 Measuring psychosocial factors is challenging due to cultural differences and the subjective nature of these variables. However, evidence increasingly shows that psychological stress is consistently linked to an elevated risk of cardiovascular disease (CVD) and cardiometabolic risk score. Stress activates the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system, leading to physiological responses that can precipitate adverse cardiac events.[6,8,16] This discrepancy in the association of perceived stress with ACS between our study and other studies may be attributed to differences in study design, population characteristics, and the specific measures of stress employed. Most studies linking perceived stress with cardiovascular risk, including ACS, are from Western countries, where socio-cultural differences can influence stress perception. Different cultures have varying stress perceptions and coping mechanisms, which might lead to underreporting or different interpretations of stress, affecting PSS scores and their association with health outcomes. Another discrepancy may be due to the smaller sample size of our study which may limit the statistical power to detect a significant association. Larger studies might have more robust findings. Additionally, variations in stress measurement tools can contribute to inconsistent results. Self-reported stress responses may be biased by negative stereotypes, potentially creating a false link between stress and heart disease. Furthermore, we assessed participants at the peak of their disease diagnosis. Although the PSS scale aims to measure stress over the past month, recall bias and a tendency to answer based on the present context rather than recalling past stress levels may have influenced the results. The significant associations between traditional risk factors-hypertension, smoking, and family history of cardiovascular disease and ACS in our study are consistent with well-established evidence.[17-19] The Framingham Heart Study and other large-scale epidemiological studies have consistently identified these factors as strong predictors of cardiovascular events.[19,20] Our finding that hypertension (OR 4.59), smoking (OR 8.48), and family history (OR 4.97) remained significant even after adjusting for perceived stress and other variables underscores the critical importance of managing these traditional risk factors in preventing ACS. Our study did not find dyslipidemia and diabetes to be independently significant predictors of ACS when adjusting for other factors, despite their higher prevalence in cases than controls. This may suggest a complex interplay between multiple risk factors where the presence of hypertension and smoking exerts a more dominant influence on the occurrence of ACS. Our study's limitations include a relatively small sample size and the use of self-reported measures for perceived stress, which may be subject to recall bias. Additionally, the cross-sectional nature of our study precludes the establishment of a causal relationship between perceived stress and ACS. Longitudinal studies with larger cohorts and objective stress measures are needed to further elucidate this relationship.

CONCLUSIONS

This study found that while perceived stress levels

were higher in ACS patients, it did not independently predict ACS when controlling for other risk factors. The significant associations of hypertension, smoking, and family history with ACS highlight the need for comprehensive risk factor management in cardiovascular disease prevention strategies. Future research should continue to explore the nuanced role of psychosocial factors in cardiovascular health to inform more holistic intervention approaches.

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