ORIGINAL ARTICLE

Cardiovascular Metrics in Hospitalized Male Patients with Acute Coronary Syndrome

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Abstract

Background: Coronary artery disease (CAD) is the leading cause of mortality globally, with a pronounced impact in India. Acute coronary syndrome (ACS), which includes unstable angina (UA), non-ST-elevation myocardial infarction (NSTEMI), and ST-elevation myocardial infarction (STEMI), is a manifestation of CAD. In 2010, the American Heart Association (AHA) introduced Life's Simple 7 (LS7) to improve cardiovascular health (CVH) by emphasizing disease prevention and lifestyle changes. This study aims to find the prevalence and distribution of LS7 metrics in hospitalized male patients with ACS compared to healthy individuals.

Methods: An observational case–control study was conducted at Government Medical College, Kota, between December 2022 and 2023, involving 50 male cases of ACS and 100 male controls, in the age-group 21–50. The Life's Simple 7 score was calculated by recording blood pressure, fasting blood glucose, total cholesterol, body mass index (BMI), diet, physical activity, and smoking/tobacco use. Scores were categorized into three groups, with 10–14 having ideal CVH, 5–9 as intermediate, and 0–4 as poor. Data were analyzed using SPSS 25.0, employing Chi-square, ANOVA, and calculating odds ratios and relative risk.

Observations: In this study, ACS cases had a mean LS7 score of 7.68, lower than the control group's 9.39, showing poorer CVH. High prevalence rates of hypertension (28%), diabetes (12%), and dyslipidemia (4%) were significant contributors to ACS, with odds ratios of 2.2, 1.94, and 1.94, respectively, and relative risks of 1.67, 1.83, and 1.83. Smoking was highly prevalent among ACS cases (96%), with an odds ratio of 12.77 and a relative risk of 1.47. Ideal BMI was present in only 48% of cases, with an odds ratio of 2.5 and a relative risk of 2.29. STEMI (78%) was prevalent among ACS cases, with single-vessel disease most common in angiographic findings.

Conclusion: The ACS cases studied had suboptimal CVH metrics compared to controls. These findings highlight the critical role of healthy lifestyles and managing modifiable risk factors in reducing ACS incidence and improving CVH outcomes.

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Introduction

In India, cardiovascular diseases (CVDs) have become the prime cause of mortality.[1] CVD affects the Indian population at least a decade earlier and in their most productive midlife years compared to the European population.[2] About 23% of CVD deaths occur before the age of 70 years in Western countries, whereas in India, this number is 52%, indicating the magnitude of the disease burden in the country.[3] Even though cardiovascular disease is preventable, the use of nicotine, decreased physical activity, and poor nutrition practices are leading to an increase in its prevalence in several countries.[4] Acute coronary syndrome (ACS) is a manifestation of coronary artery disease (CAD) and occurs as a result of plaque disruption in coronary arteries or vasospasm. It encompasses unstable angina (UA), non-ST-elevation myocardial infarction (NSTEMI), and ST-elevation myocardial infarction (STEMI).[5]

In 2010, the American Heart Association (AHA) introduced the concept of positive health promotion to improve cardiovascular health (CVH) in society, rather than focusing solely on the treatment of disease. To implement this vision, a model of ideal CVH was devised—Life's Simple 7 (LS7). Ideal CVH is defined by four health behaviors and four health factors. The behaviors include abstinence from smoking, body mass index (BMI) <25 kg/m^2, physical activity at goal levels, and a healthy diet. The ideal health factors described are nonsmoking within the last year, untreated total cholesterol <200 mg/dL, untreated blood pressure <120/80 mm Hg, and fasting blood glucose <100 mg/dL. Smoking was considered as one single component. Thus, seven health metrics were described. For each health metric, a study participant could either score 0 (poor), 1 (intermediate), or 2 (ideal) points. A total score of 0–4 points is considered poor, 5–9 intermediate, and 10–14 ideal for CVH.[6]

By examining the LS7 score in ACS, this study contributes to understanding the prevalence of cardiovascular metrics in the younger population and the importance of lifestyle modifications and preventive measures to reduce the risk of ACS.

Methods

This observational case–control study was conducted at the medicine ward, intensive care unit, and intensive coronary care unit (ICCU) of Government Medical College, Kota, Rajasthan, from December 2022 to 2023. A total of 150 male participants aged 21–50 were enrolled, including 50 cases diagnosed with ACS and 100 healthy controls. Cases were selected based on the history of typical cardiac chest pain, electrocardiogram (ECG) evidence of acute myocardial infarction, or elevated cardiac biomarkers, with no prior history of cardiovascular or cerebrovascular disease. Controls were healthy males with no history of ACS or previous cardiovascular conditions. Vital parameters, including pulse rate, blood pressure, respiratory rate, and oxygen saturation, were recorded. A 12-lead ECG, fasting blood glucose, total cholesterol, and troponin T levels were measured. Participants' lifestyle factors, including diet, physical activity, smoking, and tobacco use, were documented. The LS7 score was calculated and data analysis was performed using SPSS version 25.0. Statistical methods included Chi-squared test, ANOVA, *post hoc* Tukey test, odds ratio, and relative risk calculations, with a significance level set at $p < 0.05$.

Results

The mean age of cases was 43.08 and the standard deviation was 6.24. The distribution of ACS cases across different age-groups shows 70% of cases in the 41–50 age-group, 4% in the 21–30 age-group, and 26% in the 31–40

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age-group. This age distribution is statistically significant, with a p-value < 0.00001 ($\chi^2 = 33.91$), indicating a strong correlation between age and the occurrence of ACS. In contrast, the control group shows 33% of controls in the 21–30 age-group, 29% in the 31–40 age-group, and 38% in the 41–50 age-group. The p-value for the control group ($\chi^2 = 1.22$, $p = 0.543$) suggests no significant difference in age distribution.

Table 1: Mean values of age and cardiovascular metrics in ACS cases compared to controls

Mean (n)	*Cases*	*Controls*
Age	43.08 ± 6.24	36.3 ± 9.48
LS7 score	7.68 ± 1.92	9.39 ± 2.24
Systolic blood pressure	128.7 ± 19.7	121.2 ± 18.8
Diastolic blood pressure	82.8 ± 14.1	79.4 ± 9.9
Fasting blood sugar	101.06 ± 49.5	90.1 ± 35.31
Total cholesterol	178.94 ± 64.4	145.9 ± 36.2

Table 1 summarizes the mean values of various cardiovascular metrics in cases of ACS compared to controls. The data show that ACS cases are older and have lower LS7 scores, as well as higher levels of systolic and diastolic blood pressure, fasting blood sugar, and total cholesterol compared to controls.

Table 2 shows the distribution of CVH metrics among ACS cases and controls, highlighting the differences in adherence to LS7.

Figure 1 shows that among cases, fasting blood glucose, total cholesterol, and BMI have the highest number of participants with ideal scores. The participants with the lowest ideal scores are healthy diet, followed by smoking or tobacco consumption. The LS7 metric with the largest proportion of participants in the poor category is smoking or tobacco chewing, followed by healthy diet and blood pressure.

As shown in Figure 2, among controls, fasting blood glucose, total cholesterol, and BMI have the highest number of participants with ideal scores. The number of participants having the lowest ideal score is a healthy diet, followed by physical activity, smoking/tobacco use, and blood pressure. The LS7 metric with the largest proportion of participants in the poor category was smoking or tobacco chewing, followed by blood pressure and healthy diet.

Table 3 shows the odds ratios and relative risks for cardiovascular metrics for ACS cases and controls.

In our study, the majority of ACS cases are STEMI (78%), followed by UA (18%), and NSTEMI (4%). The majority of cases have single-vessel disease (72%), followed by double-vessel disease (20%), and a smaller proportion have no vessel involvement or recanalization (8%). Notably, no individuals have triple-vessel disease based on angiographic findings.

Table 2: Distribution of CVH metrics among ACS cases and controls

Metrics	*Cases*	*Controls*
1. LS7 score		
Poor	5 (10%)	6 (6%)
Intermediate	39 (78%)	36 (36%)
Ideal	6 (12%)	58 (58%)
2. Blood pressure		
Poor	19 (38%)	24 (24%)
Intermediate	12 (24%)	23 (23%)
Ideal	19 (38%)	53 (53%)
3. Fasting blood glucose		
Poor	8 (16%)	5 (5%)
Intermediate	0 (0%)	7 (7%)
Ideal	41 (82%)	88 (88%)
4. Total cholesterol		
Poor	5 (10%)	6 (6%)
Intermediate	8 (16%)	8 (8%)
Ideal	37 (74%)	86 (86%)
5. Smoking/tobacco consumption		
Poor	48 (96%)	62 (62%)
Intermediate	0 (0%)	5 (5%)
Ideal	2 (4%)	33 (33%)
6. Physical activity		
Poor	1 (2%)	0 (0%)
Intermediate	33 (66%)	77 (77%)
Ideal	16 (32%)	23 (23%)
7. Healthy diet		
Poor	21 (42%)	20 (20%)
Intermediate	29 (58%)	79 (79%)
Ideal	0 (0%)	1 (1%)
8. BMI		
Poor	4 (8%)	5 (5%)
Intermediate	22 (44%)	20 (20%)
Ideal	24 (48%)	75 (75%)

Table 3: Odds ratios and relative risks for cardiovascular metrics for ACS cases and controls

S. no.	*Metric*	*Odds ratio*	*Relative risk*
1.	Blood pressure	2.2	1.67
2.	Fasting blood glucose	1.94	1.83
3.	Total cholesterol	1.93	1.82
4.	Smoking/tobacco chewing	12.77	1.47
5.	Healthy diet	2.86	2.08
6.	Physical activity	0.61	0.73
7.	BMI	2.5	1.83

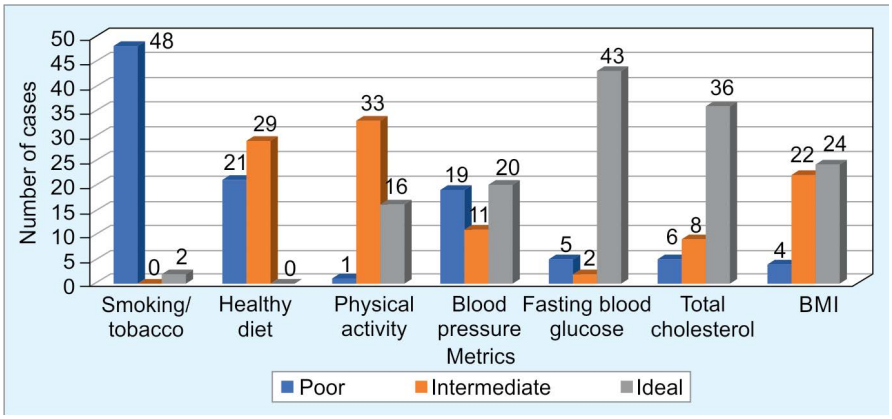

Fig. 1: Distribution of individual components of LS7 score in cases

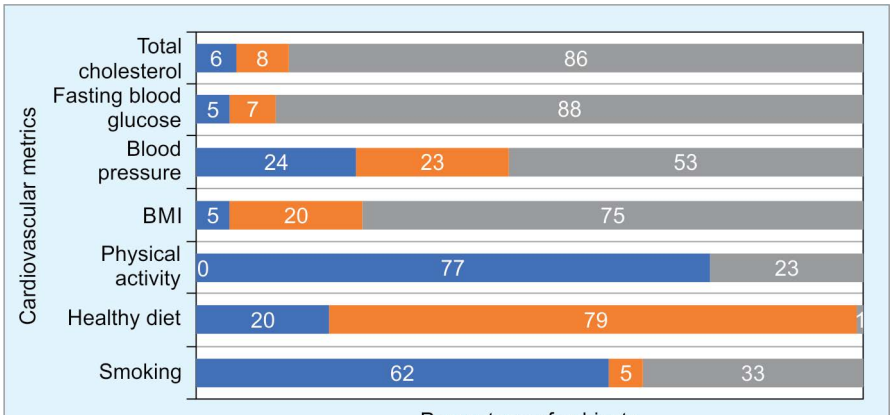

Fig. 2: Distribution of individual components of LS7 score in controls

Discussion

This study aimed to find the prevalence and distribution of LS7 score in young males with ACS, compare it to controls, and investigate the impact of modifiable risk factors in ACS. As age, sex, and family history of cardiovascular disease are nonmodifiable risk factors for ACS, males older than 50 years and female gender were excluded to avoid confounding. Vitale et al. reported a higher incidence of cardiovascular disease in men compared to women of similar age, along with highlighting the increase in cardiovascular disease among postmenopausal women.[7] Bugiardini et al. described that high-risk factor prevalence causes an earlier incidence of ACS in men as compared to women with similar risk factor burden, as atherosclerosis occurs later in women than men.[8] These demonstrate the gender-related differences that promote cardiovascular disease. Ranthe et al. reported a family history of myocardial infarction as an important independent marker of increased MI risk among individuals.[9] These findings support the exclusion of nonmodifiable risk factors from our study.

About 70% of cases were in the 41–50 age-group, with the mean age being 43.08 years, indicating the middle-aged population as more affected. The age-wise distribution in our study shows a high degree of significance, suggesting that increasing age is a critical factor for the prevalence of the disease. The odds of ACS were significantly higher for the age-group 41–50 compared to controls. Similarly, Gupta et al. and Shen et al. found that ideal cardiovascular metrics declined with aging, $p < 0.01$ and $\chi^2 = 106.746$, $p = 0.000$, respectively.[10,11]

The maximum distribution of cases belongs to the intermediate LS7 score, followed by ideal and then poor category. In contrast, a majority of the controls had an ideal score (58%), followed by intermediate (36%) and poor (6%). The LS7 score in cases ranged from 2 to 10, with a mean of 7.68 (SD 1.92), indicating suboptimal CVH. Controls had a higher mean LS7 score of 9.39 (SD 2.24), reflecting better CVH. The significant difference in LS7 score distributions between cases and controls ($p < 0.00001$) highlights the impact of CVH metrics on the risk of developing ACS.

In our study, ideal cardiovascular metrics were highest in fasting blood glucose (82%), total cholesterol (74%), and BMI (48%). The poorest metrics were seen in smoking or tobacco use (96%), healthy diet (42%), and blood pressure (38%). Physical activity showed moderate scores in 66% of cases, while none had an ideal diet. Only 4% of cases had five ideal metrics, with none achieving all seven. Similarly, Gupta et al. found that <1% of the study population involving Indian subjects had all seven ideal health factors, with most having poor CVH.[10]

The mean systolic and diastolic blood pressure among ACS cases was 128.7 and 82.8 mm Hg, respectively, with 38% having poor blood pressure metrics. Controls had lower averages of 121.2 mm Hg systolic and 79.4 mm Hg diastolic. The odds of ACS in cases with poor blood pressure metrics were 2.2 times higher than in controls, with a relative risk of 1.67. Dong et al. found that higher blood pressure significantly increased the risk of cardiovascular disease and mortality.[12] Janković et al. also noted a decline in ideal CVH as blood pressure increased, especially with age.[13]

In our study, 82% of participants had ideal LS7 scores for fasting blood glucose, compared to 88% in controls. The odds of ACS in cases with poor glucose control were 1.94 times higher, with a relative risk of 1.83, underscoring the importance of glycemic

control in CVH. Miao et al. and Ding et al. also found higher fasting glucose levels to be negatively associated with CVH scores.[14,15]

Among cases, 74% had ideal LS7 scores for total cholesterol, while 10% had poor metrics. The odds of ACS for those with poor LS7 scores were 1.93 times higher, and the relative risk was 1.82 times higher compared to controls. Elevated total cholesterol is associated with poorer CVH, as described by Leopold and Antman.[16]

In our study, 96% of cases had poor smoking metrics, compared to 62% in controls, highlighting a strong link to ACS. The odds ratio for ACS in smokers vs nonsmokers is 12.77, and the relative risk is 1.47, indicating significantly higher ACS risk in smokers. In Leopold and Antman, participants with CVD were more likely to be current or prior smokers compared to those without CVD ($p < 0.01$).[16] Additionally, young adults with CVD were more likely to be current or former smokers than older adults (50.4 vs 40.1%, $p < 0.01$).

About 42% of ACS cases had poor diet metrics, 58% had intermediate, and none had ideal metrics. Controls showed better dietary habits, with fewer having poor diets (20 vs 42% in cases). The odds ratio of 2.86 and relative risk of 2.08 indicate a significantly higher ACS risk with poor diet. Both cases and controls lacked ideal diet metrics. This highlights a critical gap in achieving optimal dietary habits across both groups, suggesting a universal need for dietary improvement to support CVH. Younus et al. reported poor diet as the lowest-scoring metric across studies, with many reporting <1% prevalence of an ideal diet.[17] Harrison et al. described diet metric as the least prevalent of "ideal" scores at 4.8%.[18] Gupta et al., in their study across 11 cities in the Indian population, described the ideal diet in 10% of the population.[10] Educational programs that focus on the benefits of a balanced diet rich in fruits, vegetables, whole grains, and decreased salt intake could significantly improve the LS7 scores and CVH outcomes.

The odds ratio and relative risk between cases and controls of 0.61 and 0.73, respectively, for ideal vs intermediate physical activity indicate that those with ideal physical activity levels are less likely to develop ACS than those with intermediate physical activity. Leopold and Antman described differences in physical activity between young adults with and without cardiovascular disease and reported fewer minutes of vigorous exercise per week ($p < 0.01$).[16] These findings emphasize the strong correlation between higher physical activity levels and better LS7 scores.

The mean BMI among cases was 24.67 compared to 23.08 in controls. The odds ratio and relative risk among cases were 2.5 and 1.83, compared to controls, indicating a substantial risk in cases. Leopold and Antman demonstrated that BMI was higher in young adults with cardiovascular disease than those without the disease (31.4 ± 8.7 vs 29.3 ± 8.0 kg/m^2, $p < 0.01$).[16]

In our study, 78% of the cases were STEMI. Allouche et al. in their study mentioned the predominance of ST elevation MI in 69% of young patients presenting with myocardial infarction.[19] Angiographic findings showed the prevalence of single-vessel disease, particularly the left anterior descending artery. Zimmerman et al. described in their study that young patients were more likely to have single-vessel disease, whereas older patients more often had multiple-vessel disease ($p < 0.0001$).[20]

Conclusion

Our study comprehensively analyses Life's Simple 7 score, its implications, and its prevalence in ACS. Suboptimal cardiovascular metrics were documented among the ACS cases compared to healthy controls. This disparity underlines the critical impact of maintaining ideal LS7 scores for reducing risk for ACS. The higher odds ratio and relative risk for ACS among cases with hypertension, diabetes mellitus, and dyslipidemia, as compared to controls, highlight the need for early detection and treatment of these risk factors. Smoking, tobacco consumption, and poor dietary habits were prevalent among ACS cases and strongly associated with lower LS7 scores, emphasizing the urgent need for lifestyle modifications for risk reduction. Higher physical activity levels demonstrated a protective effect, correlating with better LS7 scores and lower ACS incidence.

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