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Original Article

Risk Factors and Severity of Coronary Lesions in Acute Coronary Syndrome

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Abstract

Acute coronary syndrome (ACS) is associated with significant morbidity and mortality in Indonesia, with multivessel disease (MVD) linked to worse outcomes, yet individual risk factors' roles in lesion severity remain unclear in rural settings. This study is done to identify risk factors influencing coronary lesion severity (SVD vs. MVD) in ACS patients. This cross-sectional study at Dr. Doris Sylvanus General Hospital (July 2023-October 2024) included 85 ACS patients undergoing angiography/PCI, categorized by SVD (n=26, 30.6%) or MVD (n=59, 69.4%). Clinical data were extracted from emergency department records, including demographic characteristics (age, sex), medical history (hypertension, diabetes mellitus, dyslipidemia), smoking status, as well as physical examination and laboratory findings such as blood pressure, body mass index (BMI), and Free Blood Sugar levels, which were used to support the classification of corresponding risk factors. SPSS v29 facilitated bivariate/multivariate logistic regression ($p<0.05$). The findings of this study show that no individual risk factor significantly predicted MVD (all $p>0.05$; diabetes OR=2.059, p=0.409). However, ≥3 cumulative risk factors strongly associated with MVD (3 factors: 80%, p=0.022; 4-9 factors: 65.5%, p=0.038). A higher burden of cumulative risk factors, not isolated ones, is associated with MVD in this rural ACS cohort, suggesting the potential value of integrated screening for early risk stratification.

Keywords: Acute Coronary Syndrome, Coronary Lesions, Multivessel Disease, Risk Factors, Single Vessel Disease.

1. Introduction

Coronary artery disease (CAD) represents a leading cause of morbidity and mortality worldwide, characterized by plaque accumulation in coronary arteries that impairs blood flow to the myocardium, resulting in angina, myocardial infarction, and heart failure. In low- and middle-income countries like Indonesia, CAD contributes disproportionately to cardiovascular burden due to limited healthcare access, exacerbating delays in diagnosis and treatment. Acute coronary syndrome (ACS) prevalence in Indonesia reached approximately 1.5% in 2013, equating to over 2.6 million cases, with cardiovascular deaths totaling 765,660 in 2021 (GBD 2013 Mortality and Causes of Death Collaborators, 2015; World Heart Federation, 2023). Recent data highlight rising ACS incidence, with STEMI comprising a significant proportion amid dominant risk factors like hypertension and dyslipidemia (Hartopo et al., 2023).

Multivessel disease (MVD) is a predominant condition in patients with acute coronary syndrome (ACS), with a prevalence of approximately 33-50% in both STEMI and NSTEMI

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cases. These figures indicate that MVD is more frequently encountered than single-vessel disease (SVD). Overall, the distribution of cases showed a dominance of MVD at 69.4% compared to SVD at 30.6%, which is also consistent with findings in the local population of this study. MVD, defined as ≥50% stenosis in two major epicardial arteries or isolated left main lesion, demands coronary artery bypass grafting (CABG) over percutaneous coronary intervention (PCI) and yields worse outcomes including higher complications, prolonged hospitalization, and mortality (Gershlick et al., 2015; Innocentiis et al., 2017). In Central Kalimantan, absence of advanced PCI and CABG services underscores reliance on early risk stratification for revascularization planning (Batra et al., 2018; Yusuf et al., 2004).

Despite identified CAD risk factors such as hypertension, diabetes, dyslipidemia, and smoking, their specific contributions to coronary lesion severity in ACS remain unclear, particularly in resource-limited settings. Prior studies link diabetes to MVD with odds ratios of 1.341-2.059, yet inconsistencies arise in Indonesian cohorts due to sample size and methodological variations. Although individual risk factors demonstrate limited predictive power, cumulative risk clusters appear to accelerate disease progression, indicating a gap in predictive models for Indonesian cohorts (He et al., 2024; Naito & Miyauchi, 2017).

This cross-sectional study at Dr. Doris Sylvanus General Hospital examines key factors influencing coronary lesion extent in ACS patients undergoing catheterization from July 2023 to October 2024. Its urgency stems from Central Kalimantan's healthcare constraints, where predictive insights can optimize patient stratification and outcomes without advanced interventions. Novelty lies in elucidating cumulative risk effects on MVD versus SVD in this understudied rural Indonesian population, bridging global evidence with local data to inform targeted prevention (Hartopo et al., 2023; Sitompul et al., 2023).

2. Literature Review

2.1. Acute Coronary Syndrome (ACS)

Acute Coronary Syndrome (ACS) is a spectrum of cardiovascular emergency conditions caused by an acute reduction in coronary blood flow resulting from the rupture or erosion of atherosclerotic plaque that triggers the formation of an intracoronary thrombus (Collet et al., 2021). This condition encompasses ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), and unstable angina. ACS is the primary clinical manifestation of coronary artery disease with persistently high mortality rates globally (Thygesen et al., 2007).

2.2. Coronary Lesions

Coronary lesions are pathological changes in the coronary arteries resulting from the atherosclerotic process that cause narrowing of the vascular lumen. These lesions can be either stable or unstable depending on plaque composition, such as lipid content and inflammation (Libby, 2021). In ACS, vulnerable plaque is the most dangerous lesion as it is prone to rupture and causes acute thrombosis (Nijst et al., 2020).

2.3. Multivessel Disease (MVD)

Multivessel disease (MVD) is a condition in which significant stenosis is present in two or more major coronary arteries. This condition is frequently found in ACS patients with a prevalence of approximately 33-50% (Garcia-Garcia et al., 2025). Patients with MVD have a worse prognosis compared to single vessel disease due to the extent of the myocardial area experiencing ischemia and the high atherosclerotic burden (He et al., 2024). Batra et al. (2018) similarly identified MVD as a significant prognostic marker in patients undergoing primary

percutaneous coronary intervention. However, conflicting evidence exists regarding which specific risk factors drive MVD. While diabetes mellitus is a well-established risk factor for coronary artery disease generally (Naito & Miyauchi, 2017), a large Chinese ACS registry found that traditional risk factors including diabetes showed limited predictive value for MVD after multivariable adjustment (He et al., 2024). This discrepancy aligns with the cumulative risk framework, wherein the total burden of risk factors rather than any isolated factor may better explain multivessel involvement (Libby, 2021).

2.4. Single Vessel Disease (SVD)

Single vessel disease (SVD) is a coronary artery disease condition involving only one major coronary vessel with significant stenosis. SVD carries a better prognosis compared to MVD as the affected myocardial area is more limited (Kim & Yu, 2024). Nevertheless, SVD can still trigger acute ACS events, particularly when involving unstable plaque (Kumar et al., 2022). Nevertheless, SVD can still trigger acute ACS events, and evidence suggests that patients with multiple cumulative risk factors may progress from SVD to more extensive disease over time (Libby, 2021). In the Indonesian context, Hartopo et al. (2023) demonstrated that cumulative modifiable risk factors including smoking, dyslipidemia, and hypertension were strongly associated with coronary artery disease, supporting the notion that total risk burden, rather than any single factor, is the key determinant of disease severity.

3. Methods

3.1. Study Design and Methods

This observational cross-sectional study examined patients diagnosed with acute coronary syndrome (ACS) who underwent coronary angiography or percutaneous coronary intervention (PCI) at Dr. Doris Sylvanus General Hospital in Palangkaraya, Central Kalimantan, Indonesia, from July 2023 to October 2024. Patients were categorized into single-vessel disease (SVD) or multivessel disease (MVD) groups based on angiographic evidence of ≥50% stenosis in one or more major coronary arteries, with MVD defined as involvement of two major epicardial arteries or isolated left main coronary artery lesions. The design of this study refers to established protocols and clinical guidelines for the assessment of coronary artery disease (CAD) burden and its risk factor associations, such as those from the American Heart Association/American College of Cardiology (AHA/ACC) and the European Society of Cardiology (ESC), which are widely used in clinical practice and research, including in resource-limited settings.

3.2. Instruments and Data Analysis Techniques

Clinical data were extracted from emergency department records, encompassing demographic characteristics (age, sex), medical history (hypertension, diabetes mellitus, dyslipidemia), smoking status (current or former smokers), and physical examination findings including blood pressure (≥120/80 mmHg vs. <120/80 mmHg), body mass index (BMI ≥25 kg/m² vs. <25 kg/m²), and random blood sugar levels (≥200 mg/dL vs. <200 mg/dL). ACS diagnosis was established based on symptom-based criteria of typical chest pain, subsequently confirmed through electrocardiographic examination and elevated troponin levels to differentiate STEMI, NSTEMI, or unstable angina. This approach refers to the latest guidelines, such as the European Society of Cardiology (ESC) Guidelines 2020 on Acute Coronary Syndromes. Nine risk factors were evaluated to determine their association with CAD severity, namely (a) age, (b) sex, (c) hypertension, (d) diabetes mellitus, (e) dyslipidemia, (f) smoking habit, (g) obesity, (h) family history of coronary heart disease, and (i) sedentary

lifestyle. Data analysis utilized SPSS version 29, employing univariate, bivariate, multivariate logistic regression, and odds ratio calculations with 95% confidence intervals to determine statistical significance ($p<0.05$), ensuring comprehensive evaluation of variable relationships (Emzir, 2021; Sorajja et al., 2007; Sudaryono, 2022).

3.3. Population and Sampling

The study population comprised all ACS patients treated at Dr. Doris Sylvanus General Hospital meeting inclusion criteria: confirmed ACS diagnosis via angiography/PCI with ≥50% lumen diameter reduction in major coronary arteries. A total of 85 patients were included, with 26 (30.6%) classified as SVD and 59 (69.4%) as MVD, reflecting consecutive sampling to capture real-world prevalence in this rural Indonesian cohort. Exclusion criteria ensured focus on significant lesions, excluding minor or non-ACS cases, while maintaining patient anonymity, this study also upholds ethical standards. Patient anonymity and confidentiality were preserved in accordance with institutional protocols (Creswell & Creswell, 2017; Hammer et al., 2019).

3.4. Research Procedure

Patients underwent standard ACS evaluation upon admission, including clinical history, physical examination, electrocardiography, troponin assays, and coronary catheterization. Angiographic findings were used to determine SVD/MVD classification in accordance with established guidelines, applying the ≥50% luminal stenosis threshold per the 2021 AHA/ACC Guideline for the Evaluation and Diagnosis of Chest Pain (Gulati et al., 2021) and the 2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization (Lawton et al., 2022). Data collection involved retrospective review of anonymized medical records, followed by risk factor stratification and multivariable statistical modeling including logistic regression and analysis of variance to identify independent predictors of lesion severity, consistent with methods described by Moyé (2016) for cardiovascular research. All procedures adhered to applicable privacy and ethical protocols, with analyses validating cumulative risk effects on MVD progression.

4. Results and Discussion

4.1. Research Results

In total, 85 patients met the inclusion criteria; 26 patients (30.6%) were found to have single-vessel disease (SVD) and 59 patients (69.4%) had multivessel disease (MVD). In patients with ACS, 38.8% had STEMI, 35.3%-UAP and 25.9%-NSTEMI cases. Patients diagnosed with MVD have different gender distribution than those with SVD. It suggests MVD may have sex-specific effects, different from the impact SVD. The difference in sex distribution suggests that the biological or lifestyle factors may be differentially related to the development and progression of MVD between males and females. In MVD cases, females accounted for 65% and males 71%, whereas in SVD the respective figures were 35% and 29%. Regarding hypertension, patients with MVD were hypertensive in 65% of cases, compared to 35% for SVD. This shows that MVD is predominantly found in males and SVD in females suggesting a gender disparity across the two disease entities. Patients with MVD were more often hypertensive (31%), diabetic (78%) and hyperlipidemic (69%). On the other hand, smoking background was more common in cases with SVD. Notwithstanding these distinctions, none of the four risk factors (hypertension, diabetes, dyslipidemia and smoking) showed a significant association with MVD in acute coronary syndrome (ACS) patients according to

statistical analyses. This suggests that the two conditions may not be independent predictive factors for the development of MVD in these patients.

Table 1. Bivariate Analysis of Demographic Comparison of Personal History and Single Vessel Disease Group and Multiple Vessel Disease Group

Variable	SVD	MVD	p-value
Gender			
Female	7(35%)	13(65%)	0.624
Male	19(29%)	46(71%)	
Hypertension			
Yes	17(35%)	31(65%)	0.271
No	9(24%)	28(76%)	
Diabetes Mellitus			
Yes	4(22%)	14(78%)	0.386
No	22(33%)	45(67%)	
Smoking			
Yes	15(62%)	9(38%)	0.458
No	11(35%)	20(65%)	
Dyslipidemia			
Yes	10(31%)	22(69%)	0.918
No	16(30%)	37(70%)	

The bivariate analysis presented in Table 1 revealed that there were no meaningful statistical distinctions in demographic features or individual medical histories when comparing patients with single-vessel disease (SVD) to those with multivessel disease (MVD). Both groups shared comparable traits such as age, sex, and previous health conditions, with a predominance of males observed in each. This suggests that the variation between SVD and MVD is not attributable to these initial patient characteristics, with men constituting 71% of the MVD cohort and 29% of the SVD cohort, this variation did not reach statistical significance ($p = 0.624$). High blood pressure appeared more frequently in patients with multivessel disease, affecting 65% of them, compared to 35% in those with single-vessel disease; however, this difference did not reach statistical significance ($p = 0.271$). Likewise, diabetes mellitus was found more often in the multivessel group (78%) than in the single-vessel group (22%), but this variation was also not statistically significant ($p = 0.386$). In summary, the study found no meaningful differences in the prevalence of hypertension or diabetes between the two patient groups.

In contrast, a history of smoking was more common in the SVD group, affecting 62% of patients versus 38% in the MVD group, though again this difference lacked statistical significance ($p = 0.458$). The incidence of dyslipidemia was nearly equivalent between the two groups, occurring in 69% of those with MVD and 31% of those with SVD, with no significant difference observed ($p = 0.918$). Certain cardiovascular risk factors, such as high blood pressure and diabetes, appeared more frequently in patients with disease affecting multiple coronary vessels. However, no individual factor demonstrated a strong association with how severe or widespread the coronary artery disease was. This indicates that the onset and worsening of the disease likely arise from a complex interplay among several risk factors instead of being driven by just one. Therefore, a comprehensive understanding of the condition must take into account the combined impact of multiple health factors rather than focusing on each in isolation.

Table 2. Bivariate Analysis of Demographic Comparison of Risk Factors of CAD and Single Vessel Disease Group and Multiple Vessel Disease Group

Variable	SVD	MVD	p-value
Age			
<60	17(41%)	24(59%)	0.597
≥ 60	9(31%)	20(69%)	
Blood Pressure			
≥ 120/80	15(33%)	30(67%)	0.468
< 120/80	11(29%)	27(71%)	
Body Mass Index			
≥ 25	17(39%)	27(61%)	0.095
< 25	9(22%)	32(78%)	
Free Blood Sugar			
≥ 200	4(28%)	10(72%)	0.858
<200	22(31%)	49(69%)	

Table 2 reveals that individuals with multiple vessel coronary artery disease (MVD) generally displayed higher proportions across several demographic and clinical characteristics when compared with those having single vessel disease (SVD). In the MVD cohort, higher proportions were found among both younger individuals (under 60 years) and older individuals (60 years and above), as well as among patients whose blood pressure measurements were either above or below 120/80 mmHg. The same trend was noted for body mass index (BMI), with more patients in the MVD group falling into both the ≥25 kg/m² and <25 kg/m² categories. Likewise, elevated (≥200 mg/dL) and lower (<200 mg/dL) Free Blood Sugar levels were more frequently recorded among MVD patients. Nevertheless, these variations were not statistically significant, as every p-value exceeded 0.05. This means that among the participants in this study, no demographic or metabolic factors were found to be independently associated with the severity of their coronary artery disease.

Table 3. Multivariate Analysis of Risk Factors and Coronary Artery Disease

Characteristic	OR (95% CI)	P value
Gender	1.092 (0.268-4.448)	0.903
Age	1.254 (0.448-3.507)	0.667
Hypertension	0.589 (0.201-1.731)	0.336
Diabetes Mellitus	2.059 (0.371-1.416)	0.409
Smoking	1.314 (0.371-4.653)	0.672
Dyslipidemia	0.871 (0.312-2.427)	0.791
BMI	0.491 (0.179-1.343)	0.166
Free Blood Sugar	0.644 (0.118-3.505)	0.610

A multivariate logistic regression analysis was conducted to investigate the relationship between various risk factors and the presence of multivessel disease (MVD) in patients diagnosed with acute coronary syndrome. The results indicated that none of the risk factors examined showed a statistically significant association with the occurrence of MVD. Specifically, the odds ratios (OR) and their corresponding 95% confidence intervals (CI) for each factor demonstrated no meaningful predictive value. For gender, the OR was 1.092 with a 95% CI ranging from 0.268 to 4.448, and a p-value of 0.903, suggesting no significant impact. Age showed an OR of 1.254 (95% CI: 0.448-3.507; p = 0.667), also indicating a lack of significant correlation. Hypertension had an OR of 0.589 with a 95% CI between 0.201 and 1.731, and a p-value of 0.336, further confirming its non-significance.

Diabetes mellitus yielded an OR of 2.059, but with a wide 95% CI of 0.371 to 1.416 and a p-value of 0.409, indicating no definitive association. Smoking status showed an OR of 1.314 (95% CI: 0.371-4.653; p = 0.672), dyslipidemia an OR of 0.871 (95% CI: 0.312-2.427; p = 0.791), body mass index (BMI) an OR of 0.491 (95% CI: 0.179-1.343; p = 0.166), and Free Blood Sugar levels an OR of 0.644 (95% CI: 0.188-3.505; p = 0.610). Taken together, these findings suggest that none of these common clinical and demographic variables were significantly linked to the development of multivessel disease in this patient population. These findings suggest that none of these factors serve as significant predictors for the presence of MVD among this patient population.

None of the variables achieved a statistical significance, although diabetes mellitus had the highest OR (2.059), it showed that patients with diabetics are relatively more likely to experience MVD than those without. The affliction is also correlated with a much higher incidence of the complications which arise from damage to tiny blood vessels, underlining the striking difference in health outcomes between people with diabetes and those who do not have it. Therefore, rigorous screen and management of vascular health in these diabetes patients is important to reduce the risk or consequences of MVD. Nevertheless, our sample-size was small and p > 0.05 so that this conclusion should be read carefully and tested in new, larger cohorts.

Table 4. Analysis of the Correlation Between the Number of Risk Factors and Multi-Vessel Disease in ACS Patients

Number of Factors	Single-vessel disease	Multi-vessel disease	P value
1	0	1	Reference
2	3 (37,5%)	5 (62,5%)	0.095
3	4 (20%)	17(80%)	0.022
4-9	19(34,5%)	36(65,5%)	0.038
P<0.05			

It was applied by logistic repression to investigate the extent of coronary artery disease in patients with acute coronary syndrome (ACS) related with total cardiovascular risk factors as summarized in Table 4. Nine factors were evaluated: age, blood pressure, body mass index (BMI), random glucose, hypertension, diabetes mellitus, dyslipidemia and smoking history as well as other clinical data. Taking all these factors into consideration the study set out to find whether the presence of a greater number of risk factors is associated with more extensive coronary artery disease. The number of risk factors present ranged from 1 to 9, and the reference category was those participants who had just one risk factor. In this way, we were able to obtain an in-depth analysis on how the accumulation of risk factors may impact ACS patients with regard to disease progression.

None of the patients with two risk factors were statistically associated to multivessel disease (p = 0.095). Patients with at least three risk factors, however, had a significant probability of multivessel disease (p = 0.022) which was not attenuated even among those with four to nine factors (p = 0.038). There was a significant relationship between the presence of risk factors and level of coronary disease. This emphasizes that combined disease conditions such as hypertension, diabetes, dyslipidemia and smoking might become aggravating factor for the disease progression, thus early and integrated control strategies are pivotal to mitigate the risk of dreadful consequences. This highlights that a cumulation of these risk factors plays an important role in the development of acute coronary syndrome (ACS). That is, a greater number of cumulative cardiovascular risk factors is associated with more severe coronary

artery disease, emphasizing that a range of risks is involved in the development and presentation of ACS.

4.2. Discussion

ACS (Acute coronary syndrome) remains a major global health issue because of its high mortality rates and the expected increase in new cases. In a study of 85 patients with ACS, 69.4% had multivessel disease (MVD), which was significantly more common than single-vessel disease (SVD), found in only 30.6% of patients. Among the observed cases, ST-elevation myocardial infarction (STEMI) accounted for the largest proportion at 38.8%, with unstable angina pectoris (UAP) following closely at 35.3%, whereas non-ST-elevation myocardial infarction (NSTEMI) occurred least often, comprising 25.9% of the total. While the predominance of MVD over SVD is consistent with prior research, the pattern of ACS presentation in this study differs from reports where NSTEMI is most common (63.4%). Such discrepancies could reflect variations in population demographics, diagnostic methods, or regional health profiles. Patients with MVD often experience less favorable clinical outcomes, yet the risk factors contributing to its development are still not fully understood. Recognizing high-risk individuals at an early stage may enable more timely, targeted interventions and improve patient outcomes.

Members of the MVD group exhibited a greater occurrence of typical cardiovascular risk factors such as hypertension, diabetes, elevated lipid levels, and smoking suggesting that they face a higher overall risk for cardiovascular disease than those in the SVD group. They were more likely to have hypertension, diabetes, dyslipidemia, and a higher rate of smoking. This combination indicates that the MVD group has a greater overall risk for heart and vascular diseases than the SVD group. However, when looking at each risk factor individually, none of the differences were statistically significant, since all p-values were above 0.05. Likewise, the distribution of gender showed no significant relationship with the extent of disease, even though males were slightly more represented in the MVD group. These findings differ from previous research, which reported hypertension, diabetes mellitus, and smoking history as significant and modifiable contributors to CAD in the Indonesian population. Prior research has also highlighted smoking as a key determinant of CAD severity and as a factor linked to greater plaque vulnerability, myocardial infarction, and cardiovascular mortality.In the present study, smoking history was more frequently observed in SVD cases, consistent with earlier findings reporting 48.1% smoking prevalence in SVD patients.

Several clinical factors such as older age, higher blood pressure, increased BMI, and elevated Free blood sugar are more common in individuals with Multivessel Disease (MVD). These indicators are strongly linked to the presence of microvascular complications, emphasizing the need for careful monitoring of these health parameters in at-risk or affected patients. However, these differences between groups did not show statistical significance because the p-value was greater than 0.05. This indicates that, within smaller or more diverse populations, these factors may have limited ability to predict the occurrence of MVD.

The multivariate logistic regression analysis did not find any statistically significant associations between individual cardiovascular risk factors and MVD. Among the variables examined, diabetes mellitus showed the greatest odds ratio (OR = 2.059, 95% CI: 0.371-1.416, p = 0.409), suggesting a possible elevated risk for MVD, although this association was not statistically significant. Other factors such as gender, age, hypertension, smoking habits, dyslipidemia, body mass index, and Free Blood Sugar also did not demonstrate a significant relationship with MVD. This outcome differs from earlier research that recognized diabetes mellitus as an independent risk factor for MVD. For example, one earlier study reported a significant association with an OR of 1.341 (95% CI: 1.278-1.406, p = 0.01). Differences in these

outcomes may be attributed to variations in study populations, sample sizes, or research methodologies.

This study highlights a significant link between the overall count of cardiovascular risk factors and the occurrence of MVD. Patients presenting with three risk factors were found to have a substantially greater likelihood of developing MVD compared to those with just a single risk factor (p = 0.022), with this trend persisting among patients with four to nine risk factors (p = 0.038). This supports the concept of a cumulative effect, where the coexistence of multiple risk factors has a greater impact on disease severity than any individual factor alone.16 This is consistent with previous evidence emphasizing the synergistic role of clustered risk factors in accelerating CAD progression.

These findings affirm that integrated risk assessment plays a crucial role in clinical practice, particularly in resource-limited settings, where the accumulation of risk factors can serve as an important basis for promoting earlier and more aggressive intervention. This is consistent with various recent studies demonstrating that risk stratification approaches based on clinical scores retain good accuracy in predicting patient outcomes. Studies by Arispe et al. (2023) and Marlevi & Edelman (2021) indicate that scores such as TIMI and GRACE are capable of identifying patients at low and high risk for major cardiovascular events with high sensitivity, although variability in specificity remains.

Correspondingly, Meier et al. (2023) reported that several risk scoring systems, such as HEART, GRACE, and integrated clinical approaches, demonstrated relatively comparable performance in predicting short-term clinical events, including in real-world practice in emergency units. These findings reinforce that the integration of various clinical parameters remains relevant and reliable as a basis for decision-making, particularly under resource-limited conditions.

The use of integrated risk models or risk calculators based on combined scores has also been reported to improve consistency and accuracy in the patient stratification process, while simultaneously facilitating systematic clinical decision-making (Berger et al., 2021). Other findings in STEMI patient populations indicate that clinically based parameter scores, such as TIMI and GRACE, retain significant predictive value for various clinical outcomes, including mortality and complication events (Aravind et al., 2025; Ji et al., 2023; Wang et al., 2022).

The clinical implications of these findings are particularly important in healthcare facilities with limited resources. Identification of patients with a high accumulation of risk factors can assist healthcare professionals in determining earlier and more aggressive management, even without the support of advanced diagnostic modalities. These findings affirm the importance of integrated risk assessment in resource-limited settings, where cumulative risk burden can serve as a basis for decision-making toward earlier intervention, even when access to advanced revascularization procedures remains limited.

5. Conclusion

This study demonstrates that among 85 ACS patients at Dr. Doris Sylvanus General Hospital, multivessel disease (MVD) prevailed at 69.4% compared to single-vessel disease (SVD) at 30.6%, with no individual risk factors such as hypertension, diabetes mellitus (OR=2.059, p=0.409), dyslipidemia, smoking, age, gender, BMI, or elevated blood glucose showing statistically significant associations with MVD severity. However, a cumulative effect emerged, as patients with three risk factors exhibited an 80% MVD rate (p=0.022), rising to 65.5% for four to nine factors (p=0.038), underscoring the synergistic impact of clustered risks on coronary lesion progression. Practically, these findings advocate for integrated risk factor

screening in resource-limited settings like Central Kalimantan to stratify high-risk patients early, optimizing revascularization planning despite absent advanced PCI or CABG services.

Limitations include modest sample size, cross-sectional design, retrospective data reliance, and unmeasured confounders such as genetic predisposition or detailed lipid profiles. Retrospective data reliance may introduce selection bias, while unassessed confounders like genetic factors or detailed lipid profiles could influence results. Future research should employ larger, prospective multicenter studies in rural Indonesia, incorporating advanced biomarkers and longitudinal outcomes to validate cumulative risk models and explore interactions. These insights could refine national ACS guidelines, promoting holistic prevention strategies to curb CAD burden in underserved populations.

6. References

Aravind, S., Lakshmaiah, Y., Moorthy, D. K., Mohan, N. M., Prasad, K. D., Rajesh, K., & Reddy, Y. N. (2025). A Comparison of TIMI (Thrombolysis in Myocardial Infarction) and GRACE (Global Registry of Acute Coronary Events) Scores, Myocardial Blush Grade, and Shock Index-Based Indices for Predicting Outcomes in STEMI Patients Undergoing Reperfusion. *Cureus*, *17*(5), 1–9. https://doi.org/10.7759/cureus.84938

Arispe, I. N. S. R., Sol, J., Gil, A. C., Trujillano, J., Bravo, M. O., & Torres, O. Y. (2023). Comparison of heart, grace and TIMI scores to predict major adverse cardiac events from chest pain in a Spanish health care region. *Scientific Reports*, *13*(1), 17280. https://doi.org/10.1038/s41598-023-44214-3

Batra, M. K., Rasool, S. I., Solangi, B. A., Khan, N., Karim, M., & Rizvi, S. N. H. (2018). Multivessel Disease As A Prognostic Marker In Patients Presenting For Primary Percutaneous Coronary Intervention. *Journal of Ayub Medical College Abbottabad*, *30*(4), 534–538. https://pubmed.ncbi.nlm.nih.gov/30632331/

Berger, J. H., Chen, F., Faerber, J. A., O'Byrne, M. L., & Brothers, J. A. (2021). Adherence with lipid screening guidelines in standard-and high-risk children and adolescents. *American Heart Journal*, *232*, 39–46. https://doi.org/10.1016/j.ahj.2020.10.058

Collet, J.-P., Thiele, H., Barbato, E., Barthélémy, O., Bauersachs, J., Bhatt, D. L., Dendale, P., Dorobantu, M., Edvardsen, T., & Folliguet, T. (2021). 2020 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: The Task Force for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. *European Heart Journal*, *42*(14), 1289–1367. https://doi.org/10.1093/eurheartj/ehaa575

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Emzir. (2021). *Metodologi Penelitian Kuantitatif*. Prenada Media.

Garcia-Garcia, H. M., Sanz-Sanchez, J., Pinilla-Echeverri, N., Blanco, P. J., Bourantas, C., & Alfonso, F. (2025). Advances in coronary imaging of atherosclerotic plaques. *EuroIntervention*, *21*(14), e778–e795. https://doi.org/10.4244/EIJ-D-24-00387

GBD 2013 Mortality and Causes of Death Collaborators. (2015). Global, regional, and national age–sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*, *385*(9963), 117–171. https://doi.org/10.1016/S0140-6736(14)61682-2

Gershlick, A. H., Khan, J. N., Kelly, D. J., Greenwood, J. P., Sasikaran, T., Curzen, N., Blackman, D. J., Dalby, M., Fairbrother, K. L., Banya, W., Wang, D., Flather, M., Hetherington, S. L., Kelion, A. D., Talwar, S., Gunning, M., Hall, R., Swanton, H., & McCann, G. P. (2015). Randomized Trial of Complete Versus Lesion-Only Revascularization in Patients Undergoing Primary Percutaneous Coronary Intervention for STEMI and Multivessel Disease. *Journal of the American College of Cardiology*,

65(10), 963–972. https://doi.org/10.1016/j.jacc.2014.12.038

Gulati, M., Levy, P. D., Mukherjee, D., Amsterdam, E., Bhatt, D. L., Birtcher, K. K., Blankstein, R., Boyd, J., Bullock-Palmer, R. P., Conejo, T., Diercks, D. B., Gentile, F., Greenwood, J. P., Hess, E. P., Hollenberg, S. M., Jaber, W. A., Jneid, H., Joglar, J. A., Morrow, D. A., … Shaw, L. J. (2021). 2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR Guideline for the Evaluation and Diagnosis of Chest Pain. *Journal of the American College of Cardiology*, *78*(22), e187–e285. https://doi.org/10.1016/j.jacc.2021.07.053

Hammer, Y., Eisen, A., Hasdai, D., Goldenberg, I., Shlomo, N., Cohen, T., Beigel, R., Kornowski, R., & Iakobishvili, Z. (2019). Comparison of Outcomes in Patients With Acute Coronary Syndrome Presenting With Typical Versus Atypical Symptoms. *The American Journal of Cardiology*, *124*(12), 1851–1856. https://doi.org/10.1016/j.amjcard.2019.09.007

Hartopo, A. B., Inggriani, M. P., Jhundy, B. W., Fachiroh, J., Rosha, P. T., Wardani, R. K., & Dewi, F. S. T. (2023). Modifiable risk factors for coronary artery disease in the Indonesian population: a nested case-control study. *Cardiovascular Prevention and Pharmacotherapy*, *5*(1), 24–34. https://doi.org/10.36011/cpp.2023.5.e3

He, H., Wang, J., Wang, Y., Gu, R., Sun, D., Zheng, L., Tian, X., Han, Y., & Wang, X. (2024). Predictive factors for multivessel disease in patients with acute coronary syndrome: analysis from the CCC-ACS project in China. *BMC Cardiovascular Disorders*, *24*(1), 617. https://doi.org/10.1186/s12872-024-04300-4

Innocentiis, C. De, Zimarino, M., & Caterina, R. De. (2017). Is Complete Revascularisation Mandated for all Patients with Multivessel Coronary Artery Disease? *Interventional Cardiology Review*, *13*(1), 45–50. https://doi.org/10.15420/icr.2017:23:1

Ji, C., Song, F., Huang, X., Qu, X., Qiu, N., & Zhu, J. (2023). Comparison of the predictive value of the modified CADILLAC, GRACE and TIMI risk scores for the risk of short-term death in patients with acute ST segment elevation myocardial infarction after percutaneous coronary intervention. *Zhonghua Wei Zhong Bing Ji Jiu Yi Xue*, *35*(3), 299–304. https://doi.org/10.3760/cma.j.cn121430-20220727-00696

Kim, J.-H., & Yu, H.-J. (2024). The effectiveness of cognitive behavioral therapy on depression and sleep problems for climacteric women: a systematic review and meta-analysis. *Journal of Clinical Medicine*, *13*(2), 412. https://doi.org/10.3390/jcm13020412

Kumar, A. A., Yeo, N., Whittaker, M., Attra, P., Barrick, T. R., Bridges, L. R., Dickson, D. W., Esiri, M. M., Farris, C. W., & Graham, D. (2022). Vascular collagen type-IV in hypertension and cerebral small vessel disease. *Stroke*, *53*(12), 3696–3705. https://doi.org/10.1161/STROKEAHA.122.037761

Lawton, J. S., Tamis-Holland, J. E., Bangalore, S., Bates, E. R., Beckie, T. M., Bischoff, J. M., Bittl, J. A., Cohen, M. G., DiMaio, J. M., Don, C. W., Fremes, S. E., Gaudino, M. F., Goldberger, Z. D., Grant, M. C., Jaswal, J. B., Kurlansky, P. A., Mehran, R., Metkus, T. S., Nnacheta, L. C., … Zwischenberger, B. A. (2022). 2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization: Executive Summary: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *Circulation*, *145*(3). https://doi.org/10.1161/CIR.0000000000001039

Libby, P. (2021). The changing landscape of atherosclerosis. *Nature*, *592*(7855), 524–533. https://doi.org/10.1038/s41586-021-03392-8

Marlevi, D., & Edelman, E. R. (2021). Vascular Lesion–Specific Drug Delivery Systems. *Journal of the American College of Cardiology*, *77*(19), 2413–2431. https://doi.org/10.1016/j.jacc.2021.03.307

Meier, M., Boeddinghaus, J., Nestelberger, T., Koechlin, L., Lopez-Ayala, P., Wussler, D., Walter, J. E., Zimmermann, T., Badertscher, P., Wildi, K., Giménez, M. R., Puelacher, C., Glarner, N., Magni, J., Miró, Ò., Martin-Sanchez, F. J., Kawecki, D., Keller, D. I., Gualandro, D. M., … Mueller, C. (2023). Comparing the utility of clinical risk scores and integrated clinical judgement in patients with suspected acute coronary syndrome.

European Heart Journal: Acute Cardiovascular Care, *12*(10), 693–702. https://doi.org/10.1093/ehjacc/zuad081

Moyé, L. (2016). Statistical Methods for Cardiovascular Researchers. *Circulation Research*, *118*(3), 439–453. https://doi.org/10.1161/CIRCRESAHA.115.306305

Naito, R., & Miyauchi, K. (2017). Coronary Artery Disease and Type 2 Diabetes Mellitus. *International Heart Journal*, *58*(4), 475–480. https://doi.org/10.1536/ihj.17-191

Nijst, P., Martens, P., Dauw, J., Tang, W. H. W., Bertrand, P. B., Penders, J., Bruckers, L., Voros, G., Willems, R., Vandervoort, P. M., Dupont, M., & Mullens, W. (2020). Withdrawal of Neurohumoral Blockade After Cardiac Resynchronization Therapy. *Journal of the American College of Cardiology*, *75*(12), 1426–1438. https://doi.org/10.1016/j.jacc.2020.01.040

Sitompul, S. I., Pikir, B. S., Aryati, Kencono Wungu, C. D., Supandi, S. K., & Sinta, M. E. (2023). Analysis of the Effects of IL-6 -572 C/G, CRP -757 A/G, and CRP -717 T/C Gene Polymorphisms; IL-6 Levels; and CRP Levels on Chronic Periodontitis in Coronary Artery Disease in Indonesia. *Genes*, *14*(5), 1073. https://doi.org/10.3390/genes14051073

Sorajja, P., Gersh, B. J., Cox, D. A., McLaughlin, M. G., Zimetbaum, P., Costantini, C., Stuckey, T., Tcheng, J. E., Mehran, R., Lansky, A. J., Grines, C. L., & Stone, G. W. (2007). Impact of multivessel disease on reperfusion success and clinical outcomes in patients undergoing primary percutaneous coronary intervention for acute myocardial infarction. *European Heart Journal*, *28*(14), 1709–1716. https://doi.org/10.1093/eurheartj/ehm184

Sudaryono. (2022). *Metode Penelitian Pendidikan dan Pengembangan*. PT Remaja Rosdakarya.

Thygesen, K., Alpert, J. S., White, H. D., Jaffe, A. S., Apple, F. S., Galvani, M., Katus, H. A., Newby, L. K., Ravkilde, J., Chaitman, B., Clemmensen, P. M., Dellborg, M., Hod, H., Porela, P., Underwood, R., Bax, J. J., Beller, G. A., Bonow, R., Van Der Wall, E. E., ... Al-Attar, N. (2007). Universal definition of myocardial infarction: Kristian Thygesen, Joseph S. Alpert and Harvey D. White on behalf of the Joint ESC/ACCF/AHA/WHF Task Force for the Redefinition of Myocardial Infarction. *European Heart Journal*, *28*(20), 2525–2538. https://doi.org/10.1093/eurheartj/ehm355

Wang, C.-H., Wang, H.-T., Wu, K.-H., Cheng, F.-J., Cheng, C.-I., Kung, C.-T., & Chen, F.-C. (2022). Comparison of Different Risk Scores for Prediction of In-Hospital Mortality in STEMI Patients Treated with PPCI. *Emergency Medicine International*, *2022*(1), 5389072. https://doi.org/10.1155/2022/5389072

World Heart Federation. (2023). *World Heart Report 2023: Confronting the World's Number One Killer*. https://world-heart-federation.org/wp-content/uploads/World-Heart-Report-2023.pdf

Yusuf, S., Hawken, S., Ôunpuu, S., Dans, T., Avezum, A., Lanas, F., McQueen, M., Budaj, A., Pais, P., Varigos, J., & Lisheng, L. (2004). Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *The Lancet*, *364*(9438), 937–952. https://doi.org/10.1016/S0140-6736(04)17018-9