



RISK FACTORS AND INVOLVEMENT OF CORONARY VESSEL LESIONS IN YOUNG ADULTS GROUP PATIENTS UNDER 40 YEARS WITH ST-ELEVATION MYOCARDIAL INFARCTION (STEMI) AT BALARAJA HOSPITAL, BANTEN, INDONESIA : A CASE SERIES

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Article History

Volume 6, Issue Si4, 2024

Received: 16 July 2024

Accepted: 30 July 2024

Doi:

10.48047/AFJBS.6.Si4.2024.5346-5361

Background: Acute Coronary Syndrome (ACS) is increasingly affecting young patients. There are still limited studies on ACS in young patients, particularly in the Banten region. Therefore, our study aimed to investigate the risk factors and involvement of coronary vascular lesions in young patients.

Case Description: This case series collected data through a retrospective review of the medical records of STEMI patients under the age of 40 who underwent primary percutaneous coronary intervention (Primary PCI). 180 patients with STEMI were found. Among the 180 STEMI patients, 11 patients (6.2%) were below 40 years of age, and 3 out of 11 patients (1.6%) underwent primary PCI. All three patients were male (100%) and clinical presentations included inferior STEMI (66.6%), anteroseptal STEMI (33.3%), and total AV block (33.3%). Smoking was the predominant risk factor (100%), followed by hypertension (66.6%), dyslipidemia (66.6%), and elevated blood sugar levels (66.6%). Echocardiographic examination revealed reduced left ventricular ejection function in one patient (33.3%). Single-vessel disease was common (66.6%), primarily involving the Left Anterior Descending (LAD) and Right Coronary Artery (RCA).

Discussion: STEMI in young patients predominantly affects males, and the most dominant risk factor among the three cases was smoking, which accelerates the development of atherosclerosis. The high incidence of single-vessel disease, primarily in the LAD and RCA, suggests the influence of anatomical factors, vasospasm, and comorbidities.

Conclusion: STEMI in young patients is primarily seen in males and with a high prevalence of single-vessel disease, involving the LAD and RCA in STEMI patients. Smoking emerges as a major risk factor. Understanding the risk factors and coronary vessel involvement in this population can aid in early detection, prevention, and management of ACS in young individuals.

Keywords: acute coronary syndrome, risk factors, coronary vessel lesions, young patients.

1. INTRODUCTION

Cardiovascular diseases account for one-third of global deaths. Acute Coronary Syndrome (ACS) contributes to over 8.1 million deaths annually.¹ The prevalence of Acute Coronary Syndrome in Indonesia has been increasing yearly, according to surveys conducted by the Indonesian Ministry of Health.² ACS leads to heart decompensation due to the inadequate blood supply to the heart.² This occurs because of an imbalance between oxygen supply and demand due to arterial narrowing or obstruction caused by atherosclerosis.² Acute Coronary Syndrome is classified into Unstable Angina Pectoris, Non-ST-Elevation Myocardial Infarction (NSTEMI), and ST-Elevation Myocardial Infarction (STEMI).³

The prevalence of ST-elevation Acute Coronary Syndrome in Indonesia has increased by 15% in recent years.¹ Clinical manifestations of ACS in most cases occur in the fifth to seventh decades of life, with only 2-10% of all ACS patients being under the age of 40.⁴ Previous studies have shown that family history, lack of physical activity, obesity, and smoking are the most common risk factors for ACS in young adults.⁴ ACS in young adults has a low incidence of multi-vessel disease (MVD) and left main (LM) disease, whereas Left Anterior Descending (LAD) involvement is more common.⁴ Invasive coronary angiography reduces ACS complications (death, recurrent myocardial infarction, stroke) for patients with NSTEMI.⁵ Guidelines recommend an invasive strategy within 2 hours for very high-risk patients, within 24 hours for high-risk patients, and within 72 hours for intermediate-risk patients.⁵ Similarly, for STEMI, reperfusion can be achieved with primary percutaneous coronary intervention (PCI) or fibrinolysis.⁵

As indicated by the data above, the incidence and mortality rates of coronary heart disease (CHD) or Acute Coronary Syndrome (ACS) remain high, and the number of hospital admissions is also increasing, leading to economic burdens on the healthcare system in Indonesia.

In this study, we examined cases of STEMI patients under the age of 40 at Balaraja General Hospital from January 2022 to December 2022. A total of 180 STEMI patients were identified, with 11 being under 40 years old. Of these 11 young STEMI patients, three underwent PCI.

Therefore, given the increasing incidence of Acute Coronary Syndrome in young adults, this study aims to analyze the risk factors and coronary artery lesion involvement in young adults with ACS undergoing cardiac catheterization at Balaraja General Hospital.

2. CASES

2.1 CASE 1

2.1.1 Case History of Patient 1

CASE 1 (Mr. NA)

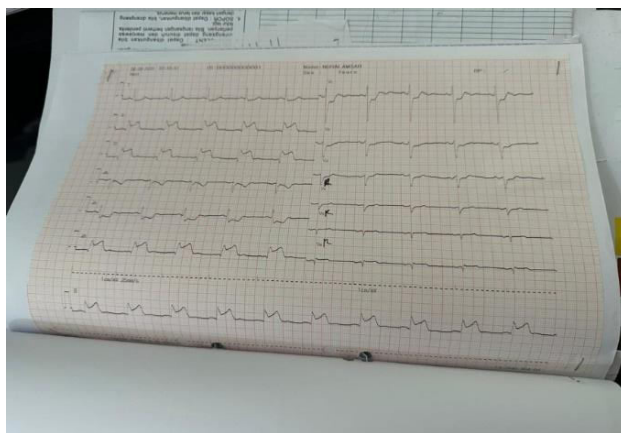
A 37-year-old male presented to the Emergency Room of Balaraja General Hospital with complaints of chest pain described as a heavy pressure sensation for the past 3.5 hours before admission. The chest pain radiated to the back, neck, and both arms, and was accompanied by shortness of breath, cold sweats, and palpitations. The chest pain was sudden in onset during physical activity and did not improve with rest. This was the first episode of chest pain the patient had experienced. The patient reported a smoking habit of one pack per day, daily coffee consumption, irregular fruit intake, and vegetable consumption 3-4 days per week. He consumed oily/fried foods approximately 3-4 times a week and frequently ate instant or junk food about 6-7 times a week. He denied alcohol consumption. The patient exercised irregularly, about 1-2 times a month. He also had a history of uncontrolled hypertension and was not consistent with taking antihypertensive medications. There was no family history of

coronary heart disease. The patient had received three doses of the Covid-19 vaccine and had never contracted Covid-19.

On vital signs examination, he was conscious and moderately ill, with a blood pressure of 170/100 mmHg, pulse rate of 110 beats per minute, respiratory rate of 24 breaths per minute, temperature of 36.8°C, and oxygen saturation of 98% on room air. Physical examination revealed no conjunctival pallor or jaundice. There was no jugular venous pressure elevation or lymphadenopathy on neck examination. Thoracic examination showed vesicular breath sounds without rhonchi or wheezing, and regular heart sounds S1 and S2 with no murmurs or gallops. Abdominal examination revealed normal bowel sounds (5 per minute) without tenderness, ascites, or hepatosplenomegaly. The extremities were warm with a capillary refill time of less than 2 seconds, and there was no edema in the arms or legs.

2.1.2 Investigations, Diagnosis and Medications

Laboratory results showed Hb 13.9, Ht 43, leukocytes 13,850, platelets 342,000, random blood sugar (RBS) 112, total cholesterol 185, triglycerides 247, HDL cholesterol 58, LDL cholesterol 109, PT/APTT 9.3/36.4, CKMB 48, and a negative Covid-19 antigen swab test. The ECG showed ST elevation in leads II, III, and aVF as well as leads V7, V8, and V9. The coronary angiography report revealed coronary artery disease (CAD) with one vessel disease (VD) involving the culprit right coronary artery (RCA). The treatment administered included a nitroglycerin (NTG) drip starting at 5 mcg/min, titrated up by 5 mcg increments, with a maximum of 200 mcg/min, targeting blood pressure <140/90 mmHg; a loading dose of aspirin 320 mg followed by 80 mg once daily; a loading dose of clopidogrel 300 mg followed by 75 mg once daily; a bolus of heparin 60 units/kg body weight followed by an infusion of 12 units/kg body weight per hour; diazepam 2 mg orally once daily; laxadin 15 cc once daily; lisinopril 5 mg once daily; and bisoprolol 2.5 mg once daily.



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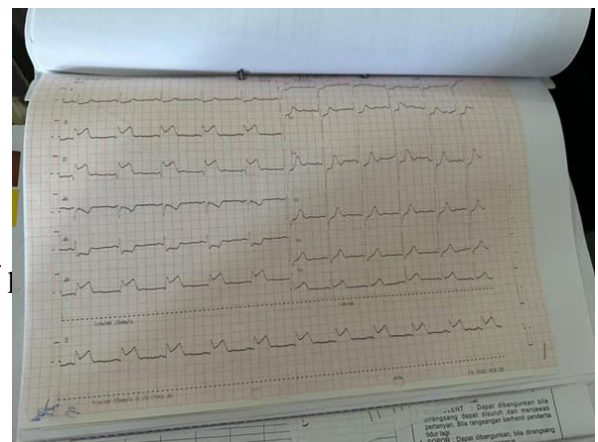




Figure 2. Angiography results of pre-PCI patientcase 1



Figure 3. Angiography results of post-PCI patientcase 1

2.2 CASE 2

2.2.1 Case History of Patient 2

CASE 2 (Mr.M)

A 34-year-old male presented to the Emergency Room of Balaraja General Hospital with complaints of chest pain radiating to the chin and left arm for the past 8 hours before admission. The chest pain was described as a squeezing sensation accompanied by cold sweats during the attack, lasting less than 10 minutes, and was intermittent. The chest pain was sudden in onset, occurring while the patient was asleep, and was severe enough to wake him. The pain was associated with nausea but without vomiting. The patient reported a smoking habit of 2-3 packs per day, irregular coffee consumption, and irregular fruit and vegetable intake. He consumed oily or coconut milk-based foods almost daily, and regularly consumed instant or junk food every day. He denied alcohol consumption and exercised irregularly, about 1-2 times a month. The patient also had a history of hypertension, diabetes, and high cholesterol but had never followed up or received treatment. There was no family

history of coronary heart disease. The patient had not received the Covid-19 vaccine and had never contracted Covid-19.

On vital signs examination, he was conscious and moderately ill, with a blood pressure of 120/70 mmHg, a pulse rate of 54 beats per minute, a respiratory rate of 20 breaths per minute, a temperature of 36.8°C, and an oxygen saturation of 98% on room air. Physical examination revealed no conjunctival pallor or jaundice. There was no jugular venous pressure elevation or lymphadenopathy on neck examination. Thoracic examination showed vesicular breath sounds without rhonchi or wheezing, and heart sounds S1 and S2 were irregularly bradycardic with no murmurs or gallops. Abdominal examination revealed normal bowel sounds (5 per minute) without tenderness, ascites, or hepatosplenomegaly. The extremities were warm with a capillary refill time of less than 2 seconds, and there was no edema in the arms or legs.

2.2.2 Investigations, Diagnosis and Medications

Laboratory tests revealed Hb 12.2, Ht 39, leukocytes 19,540, platelets 293,000, RBS 218, PT/APTT 10.4/32.5, CKMB 154, SGOT 45, SGPT 29, urea 21, creatinine 1.0. The lipid profile showed total cholesterol 210 mg/dL, LDL cholesterol 160 mg/dL, HDL cholesterol 40 mg/dL, and triglycerides 245 mg/dL. The Covid-19 antigen swab test was negative. The ECG showed ST elevation in leads II, III, and aVF, along with dissociation of P waves and QRS complexes. The echocardiography concluded concentric left ventricular hypertrophy (LVH) with normal LV systolic function and a left ventricular ejection fraction (LVEF) of 52% (biplane), normokinetic at rest, diastolic dysfunction grade II, mild aortic regurgitation (AR), low probability of pulmonary hypertension (PH), and normal right ventricular (RV) contractility. The coronary angiography report showed coronary artery disease (CAD) with 2-vessel disease (VD), total occlusion of the right coronary artery (RCA) as the culprit, and successful primary PCI with one drug-eluting stent (DES) placement. The patient was diagnosed with inferior STEMI and total AV block. The medication regimen included ISDN 5 mg sublingual, a loading dose of aspirin 320 mg followed by 80 mg once daily, a loading dose of clopidogrel 300 mg followed by 75 mg once daily, a heparin bolus of 60 units/kg body weight followed by an infusion of 12 units/kg body weight per hour, laxadin 15 cc once daily, lisinopril 5 mg once daily, and bisoprolol 2.5 mg once daily.

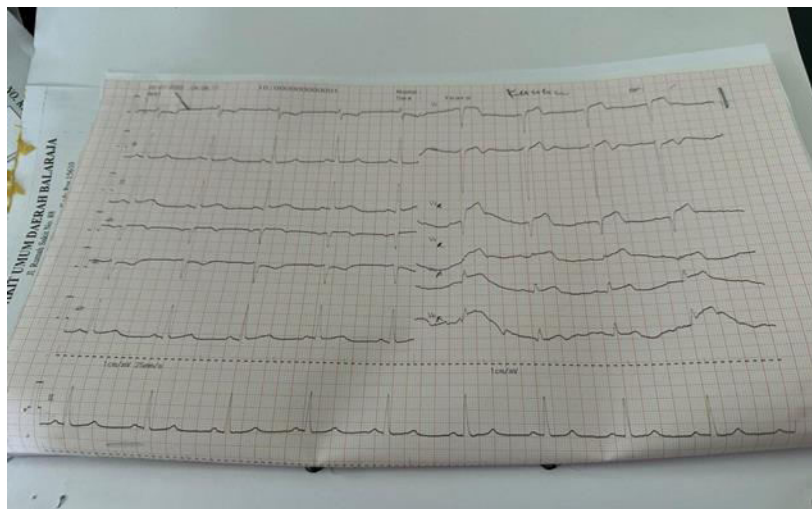


Figure4. ECG result of patient case 2



Figure 5. Angiography results of pre-PCI patient case 2

2.3 CASE3

2.3.1 Case History of Patient 3

CASE 3 (Mr. AM)

A 32-year-old male presented to the Emergency Room of Balaraja General Hospital with complaints of sharp, stabbing chest pain that worsened over the past 6 hours before admission. The chest pain radiated to the back and left shoulder. The pain was accompanied by nausea, cold sweats, and palpitations. The patient reported experiencing similar intermittent chest pain for one week prior to admission. The pain occurred suddenly during both activity and rest, lasting for about 3 minutes, and each episode was associated with palpitations, nausea, and cold sweats. The patient had a smoking habit of 1-2 packs per day, irregular coffee consumption, irregular fruit intake, daily vegetable consumption, and oily or coconut milk-based food intake 1-2 days per week. He consumed instant or junk food 2-3 times per week and had a history of alcohol consumption of 3-4 bottles per month. He exercised once a week for 30-60 minutes. The patient had a history of high cholesterol and was not consistent with taking cholesterol-lowering medications. There was no family history of coronary heart disease. The patient had not received the Covid-19 vaccine but had a history of Covid-19 illness.

On examination, the patient's vital signs were stable. He was conscious and appeared moderately ill, with a blood pressure of 130/85 mmHg, a pulse rate of 88 beats per minute, a respiratory rate of 18 breaths per minute, a temperature of 36.7°C, and an oxygen saturation of 99% on room air. Physical examination revealed no conjunctival pallor or jaundice. There was no jugular venous pressure elevation or lymphadenopathy on neck examination. Thoracic examination showed vesicular breath sounds without rhonchi or wheezing, and heart sounds S1 and S2 were regular without murmurs or gallops. Abdominal examination revealed normal bowel sounds (5 per minute) without tenderness, ascites, or hepatosplenomegaly. The extremities were warm with a capillary refill time of less than 2 seconds, and there was no edema in the arms or legs.

2.3.2 Investigations, Diagnosis and Medications

Laboratory tests revealed Hb 14.2, Ht 43, leukocytes 13,480, platelets 185,000, random blood sugar (RBS) 87, SGOT 304, SGPT 65, urea 18, creatinine 0.9, sodium 134, potassium 4.0, chloride 99, total cholesterol 153, triglycerides 96, LDL cholesterol 92, HDL cholesterol 42, and troponin 11.57. The Covid-19 antigen swab test was negative. The ECG showed ST

elevation in leads V1, V2, V3, and V4. Echocardiography revealed concentric left ventricular hypertrophy (LVH), reduced LV systolic function with a left ventricular ejection fraction (LVEF) of 37%, severe hypokinesis of the anteroapical and anterior anterolateral walls, grade II diastolic dysfunction, normal valves, low probability of pulmonary hypertension (PH), and normal right ventricular (RV) contractility. The coronary angiography report indicated coronary artery disease (CAD) involving the left anterior descending (LAD) artery. The patient was diagnosed with anteroapical STEMI. The treatment administered included ISDN 5 mg sublingual for chest pain, a loading dose of aspirin 320 mg followed by 80 mg once daily, a loading dose of clopidogrel 300 mg followed by 75 mg once daily, a heparin bolus of 60 units/kg body weight followed by an infusion of 12 units/kg body weight per hour, lisinopril 5 mg once daily, and bisoprolol 2.5 mg once daily.

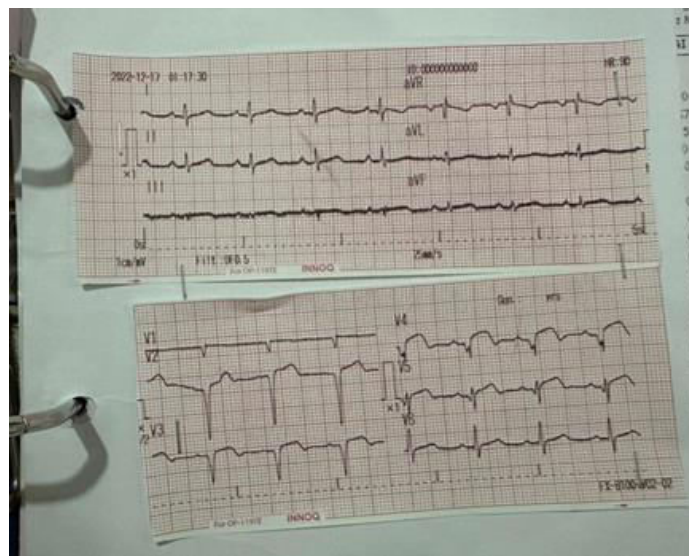
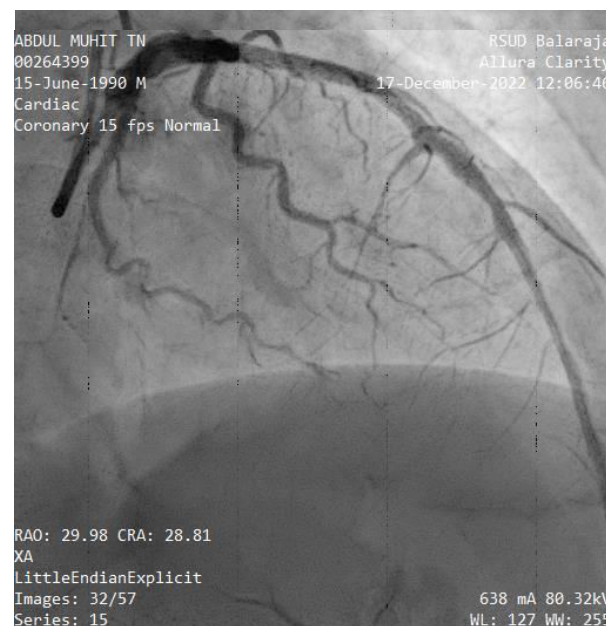


Figure 6. ECG result of patient case 3

Figure 7. Angiography results of pre-PCI patient case 3



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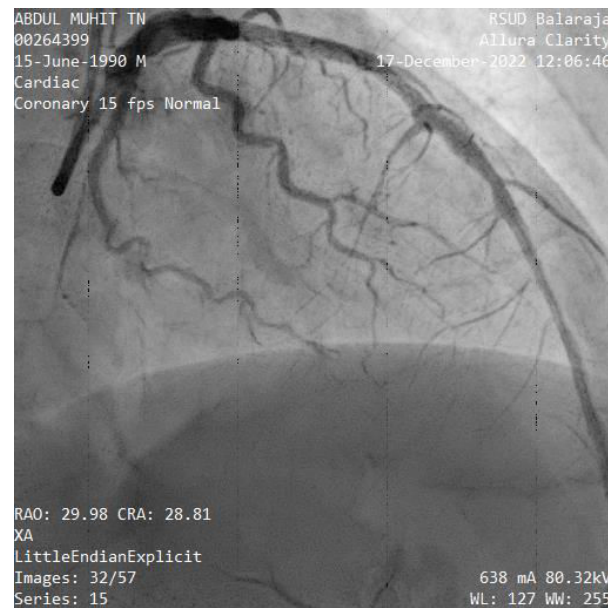


Figure 8. Angiography results of post-PCI patientcase 3

3. DISCUSSION

We collected data from January 2022 to December 2022, identifying 180 patients with STEMI, of whom 11 (6.2%) were under the age of 40. Among these 11 patients with STEMI who were under 40 years old, three underwent percutaneous coronary intervention (PCI).

Table 1. Data on Patients with STEMI at Balaraja General Hospital for the Period 2022

	STEMI	Percentage(%)	PCI	Percentage (%)
Age > 40 years	169 patients	93.8 %	30 patients	90.9 %
Age < 40 years	11 patients	6.2 %	3 patients	9.1 %
Total	180 patients		33 patients	

In the three cases of STEMI in the young adults group (under 40 years) who underwent PCI at Balaraja General Hospital, all three cases were found in young adult males with no prior history of heart disease and no family history of coronary heart disease. This indicates that coronary artery disease is beginning to manifest at a younger age, even in the absence of previous symptoms.

Coronary artery disease (CAD) or myocardial infarction remains a leading cause of morbidity and mortality in Indonesia.⁶ CAD occurs due to a reduction in oxygen supply to the heart caused by blockage or narrowing of the coronary vessels due to atherosclerosis, spasm, or a combination of both. According to Riskesdas data, the prevalence of cardiovascular diseases such as hypertension increased from 25.8% in 2013 to 34.1% in 2018, while the prevalence of coronary artery disease remained at 1.5% from 2013 to 2018.⁷ Risk factors for CAD can be categorized into modifiable and non-modifiable. Modifiable risk factors include smoking, dyslipidemia, hypertension, obesity, lack of physical activity, and lifestyle. Non-modifiable risk factors include age, gender, and genetics.⁸

Table 2. Profile of Characteristics, Symptoms, and Supporting Examinations of Patients

Characteristics	Patient 1	Patient 2	Patient 3
Age	37 years	34 years	32 years
Gender	Man	Man	Man
Chest Pain	Yes	Yes	Yes
Onset of Attack	3.5 hours	8 hours	6 hours
Pain Radiation	Back, neck, and both arms	Chin and left arm	Back and left shoulder
Life Style			
Smoke	1 pack/day	2-3 packs/day	1-2 packs/day
Alcohol	No	No	3-4 bottles/month
Coffee	Every morning	< 1 a week	< 1 a week
Oil Consumption	3-4 days/week	+/- everyday	1-2 days/week
Instant/ junkfood	6-7 times/week	+/- everyday	2-3 times/week
Exercise	1-2 times/month	1-2 times/month	1 times/week
Physical Examination			
Blood Pressure	170/100 mmHg	120/70 mmHg	160/100 mmHg
Heart Rate	110 x/min	54 x/min	93 x/min
Jugular Vein Pressure	5+3	5+3	5+3
Heart Sounds S1-S2 (regular/irregular)	regular	irregular	regular
Murmur/ Gallop	no	no	no
Laboratory			
Hemoglobin	13.9 g/dL	12.2 g/dL	14.2 g/dL
Hematocrit	43%	39%	43%
Leukocytes	13,850 μ /L	19,540 μ /L	13,480 μ /L

Platelets	342,000 μ /L	293,000 μ /L	185,000 μ /L
Random Blood Sugar	112 mg/dL	218 mg/dL	87 mg/dL
CKMB	48 μ g/L	154 μ g/L	N/A
Troponin	N/A	N/A	11,57 μ g/L
Profil Lipid			
LDL	109 mg/dL	160 mg/dL	92 mg/dL
HDL	58 mg/dL	40 mg/dL	42 mg/dL
Total Cholesterol	185 mg/dL	210 mg/dL	153 mg/dL
Triglycerides	247 mg/dL	245 mg/dL	96 mg/dL
ECG	ST Elevation in leads II, III, aVF, V7-V9	ST Elevation in leads II, III, aVF + Total AV block	ST elevation in leads V1-V4
Diagnosis	STEMI Inferoposterior	STEMI Inferior + RV Infact + TAVB	STEMI anteroseptal
Echocardiogram	N/A	• left ventricular hypertrophy • Normal LV systolic function with left ventricular ejection fraction (LVEF) 52% (biplane) normokinetic at rest • diastolic dysfunction grade II • Mild AR • low probability of PH • normal RV contractility.	• concentric LVH, • reduce LV systolic function with LVEF 37%, • severe hypokinetic anteroseptal dan anterior anterolateral, • diastolic dysfunction grade II, • normal valves • low probability PH • normal RV contractility
Angiography			
CAD - Vessels	1 vessel disease-RCA (right coronary	CAD 2 vessels total	CAD 1 vessel disease -LAD (Left

	artery)	occlusion of RCA (right coronary artery) (Culprit) RCA and LAD	anterior Descending) disease
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In the three cases of STEMI in the young adults population, where patients are under 40 years old, it is noteworthy that coronary artery disease typically occurs at an average age of 45-64 years.⁸

According to research, age significantly affects the incidence of coronary artery disease (CAD). For example, Lannywati et al. found that respondents aged ≥ 40 years were 2.72 times more likely to develop CAD compared to those under 40 years. After adjusting for other variables, the risk for those aged ≥ 40 years increased to 3.70 times (95% CI 3.04 – 4.50, $p < 0.0001$). As age increases, the risk of developing CAD also rises due to the accumulation of plaques on arterial walls, which impairs blood flow. Research by Donald at RSU Pirngadi in Medan supports these findings, showing a higher prevalence of CAD in individuals aged ≥ 40 years.¹⁰ However, CAD cases in individuals under 40 years are increasingly reported, suggesting early-onset atherosclerosis or other mechanisms such as coronary vasospasm, thrombosis, hypercoagulable states, or coronary trauma. Coronary vasospasm, in particular, can lead to coronary damage, increased platelet aggregation, and activation of the coagulation system, resulting in thrombosis and myocardial infarction.²³

Another risk factor is gender, as studies show that men are at a greater risk of experiencing coronary artery disease (CAD) and tend to develop it earlier than women. The morbidity associated with CAD in men is twice as high compared to women, and this condition occurs almost a decade earlier in men. This disparity is attributed to endogenous estrogen, which has a protective effect in women by lowering LDL (low-density lipoprotein) levels and platelet aggregation.¹² After menopause, the incidence of CAD increases in women, but not to the same extent as in men.¹⁰ This finding aligns with cases observed at RSUD Balaraja, where all three CAD cases involved male patients.

Regarding hypertension, 2 out of 3 patients in the aforementioned cases had hypertension and did not adhere to antihypertensive medication. Studies indicate that hypertension is the most frequent risk factor for cardiovascular events (55.8%), followed by obesity (14.4%) and diabetes mellitus (9.8%).¹⁴ According to the WHO, the prevalence of hypertension in Indonesia is 42.7% in men and 39.2% in women.¹² In Banten, the prevalence of hypertension is 27.6%. Hypertension can accelerate atherosclerosis through several mechanisms. Animal studies show that elevated blood pressure can damage vascular endothelial cells and increase the permeability of blood vessel walls to lipoproteins. Angiotensin II, a mediator of hypertension, not only acts as a vasoconstrictor but also stimulates oxidative stress.¹⁶

Next, dyslipidemia is another significant risk factor. One out of two patients in the aforementioned cases had dyslipidemia and did not adhere to cholesterol-lowering medications. Data from the Framingham Heart Study and other cohort studies show that the risk of coronary artery disease (CAD) increases with high serum total cholesterol levels. Individuals with total cholesterol levels of 240 mg/dL have a higher coronary risk compared to those with levels of 200 mg/dL. Excessive LDL cholesterol can accumulate in the subendothelium and undergo chemical modifications that damage the endothelial intima of blood vessels.¹⁶ According to WHO data, the highest prevalence of elevated cholesterol is observed in Europe (53.7%), followed by America (47.7%), Asia (30.3%), and Africa (23.1%). In Asia, the prevalence is highest in the Philippines (46.9%), followed by Indonesia (35.8%) and Singapore (17.4%). In Banten, the prevalence of high cholesterol is 38.2%.¹⁸

Diabetes mellitus (DM) is another crucial risk factor. According to the American Heart Association, at least 65% of individuals with diabetes mellitus experience heart disease or stroke. Moreover, adults with diabetes are 2 to 4 times more likely to develop heart disease compared to those without diabetes. Diabetes accelerates tissue degeneration and endothelial dysfunction, leading to thickening of the basal membrane of capillaries and coronary arteries, which results in reduced blood flow to the heart. Elevated blood glucose levels increase blood viscosity, enhancing the likelihood of atherosclerosis and consequently contributing to coronary artery disease.¹⁰

Another critical risk factor to consider is lifestyle habits such as smoking, physical activity, alcohol consumption, and diet. In the three cases described, all patients reported a smoking habit of 1-2 packs per day. According to the World Heart Federation, nicotine from tobacco in cigarettes can reduce the oxygen levels delivered by the blood and make it more prone to clotting.¹⁰ Blood clots formed in the arteries can lead to coronary artery disease, stroke, and sudden death.¹⁰ Nicotine and carbon monoxide inhaled through smoking damage the endothelial lining of blood vessels and contribute to the formation of atherosclerotic plaques.¹³ In Banten province, the smoking prevalence was 24.3% nationally and 26.77% for Banten in 2018.¹⁹ This indicates that Banten had a higher percentage of smokers compared to the national average in 2018.¹⁹ Nationally, smoking rates for men were 47.3%, while for women it was only 1.2%.¹⁹ According to Riskesdas Banten province in 2019, Lebak district had the highest smoking prevalence at 33.06% in 2018, while South Tangerang district had the lowest at 21.86% in the same year.¹⁹

Regarding physical activity, exercise induces two primary cardiovascular changes: an increase in cardiac output and a redistribution of blood flow from less active to more active organs. Regular aerobic exercise reduces the risk of coronary artery disease (CAD), although only 11% of men and 4% of women meet the government's physical activity targets. It has been concluded that regular exercise decreases systolic blood pressure, reduces circulating catecholamine levels, lowers cholesterol and blood fat levels, increases HDL lipoprotein levels, improves coronary circulation, and enhances self-confidence. Regular exercise is associated with a 20-40% reduction in CAD incidence. Engaging in regular physical activity is highly beneficial for reducing risk factors such as increasing HDL cholesterol, improving insulin sensitivity, and decreasing body weight and LDL cholesterol levels.²⁰

In the cases discussed, all three patients did not engage in regular physical activity as recommended by health guidelines. Additionally, many people now rely on online delivery services, leading to even less physical activity. This observation aligns with studies indicating increased CAD risk associated with lower physical activity levels.

Changes in dietary patterns can significantly impact the incidence of coronary artery disease (CAD). Dietary habits are influenced by customs, culture, and environmental factors. High intake of saturated fats, such as from fried foods and junk food, increases the risk of CAD. According to Riskesdas (2013), 40.7% of the Indonesian population consumes high-fat foods, cholesterol-containing foods, and fried foods more than once a day. Such a diet raises levels of LDL-C and triglycerides. Excess LDL can accumulate in the subendothelium and undergo oxidation, which damages the intima and exacerbates atherosclerotic lesions.¹⁶

Myocardial Infarction in Young Adults: Risk Factors and Coronary Artery Involvement

Coronary artery disease (CAD) generally manifests in individuals over the age of 40. However, cases at RSUD Balaraja reveal that CAD can also present in younger adults under 40. This study aims to investigate the risk factors and angiographic profiles of young adults with acute myocardial infarction (AMI).

Table 3. Angiographic Findings in Patients Under 40 Years of Age at RSUD Balaraja, 2022

Stenosis	Patient 1	Patient 2	Patient 3
RCA	Total occlusion	Total occlusion	Stenosis 50%
LM	There is no stenosis	There is no stenosis	There is no stenosis
LAD	There is no stenosis	Stenosis 70%	Stenosis 90%
LCx	There is no stenosis	Stenosis 20%	There is no stenosis
Vessels disease involved	Single vessel disease	Double vessel disease	Single vessel disease
Impression	1 vessel disease- RCA (right coronary artery)	CAD 2 vessels disease- total occlusion RCA (right coronary artery) (Culprit) RCA and LAD	CAD 1 vessel disease -LAD (Left anterior Descending) disease

*RCA (Right Coronary Artery); LM (Left Main); LAD (Left Anterior Descending); LCx (Left Circumflex Artery)

Coronary artery disease (CAD) in young adults is largely the result of early-onset atherosclerotic processes. A study by Milanig et al., which involved a necropsy of 760 young patients, found that coronary heart disease (CHD) was present in 20% of men and 8% of women within the 30-34 age group.²¹

The most prevalent risk factor for CAD in young adults is smoking. In this case study, all three patients had a smoking habit of at least 1-2 packs per day. This is supported by Zimmerman et al., who found a 92% prevalence of smoking among young CAD patients, and Mukherjee et al., who reported higher smoking prevalence in individuals under 40 compared to those over 60.²¹ Additionally, the study by Bhardwaj et al. highlighted that myocardial infarction in young adults under 40 years old occurs exclusively in men. The primary risk factors identified are smoking, hypertension, elevated triglyceride levels, and low HDL cholesterol. The most frequently involved coronary lesion is single vessel disease affecting the anterior wall in myocardial infarction.²¹

In this study, Case 1 presented with risk factors including hypertension, smoking, and dyslipidemia. Case 2 had multiple risk factors such as dyslipidemia, smoking, diabetes, and a history of hypertension, while Case 3 had hypertension and a smoking habit. All cases involved male patients. Angiographic findings in young adults with CAD revealed a predominance of single vessel disease.

Of the three patients who underwent PCI, two had single vessel disease and one had double vessel disease. Specifically, in Case 3, PCI results showed single vessel disease with occlusion in the Left Anterior Descending (LAD) artery. This observation is consistent with

findings from Isnanta et al., who reported that among 72 patients under 45 years of age, a majority had single-vessel disease (43.1%). In contrast, patients older than 45 years more frequently exhibited triple vessel disease (31.6%). The LAD was the most commonly affected artery in both age groups. The prevalence of single vessel disease coupled with smoking and hypertension was notably common among younger patients.²²

In a systematic review by Salehi et al., it was demonstrated that smoking is associated with the severity of coronary artery involvement. The study also indicated that smoking is linked with occlusion of the LAD artery and that smokers are more likely to have occlusion of non-proximal coronary arteries. However, the relationship between smoking and the location of coronary occlusions still requires further investigation. The effects of smoking and nicotine on the endothelial cells of coronary arteries include increased sympathetic tone and vasospasm. Myocardial necrosis can be caused by nicotine effects. Generally, smoking and nicotine result in two types of necrosis: ischemic necrosis and toxic necrosis, with the myocardium being affected by the chemicals in cigarettes.²³

In patient case 1, the PCI results showed single-vessel disease with occlusion in the RCA (right coronary artery). In another case, patient case 2, the PCI results revealed double-vessel disease with CAD involving the LAD and total occlusion of the RCA, which was identified as the culprit. Single-vessel occlusion in the RCA is less commonly reported compared to isolated occlusion in the LAD among younger patients with coronary artery disease under 40 years of age. This discrepancy may be attributed to anatomical factors. The right coronary artery (RCA) provides more uniform blood flow throughout the cardiac cycle compared to the left coronary artery (LCA), which experiences significant systolic reduction and increased diastolic pressure. The LCA, particularly the left anterior descending artery (LAD), is subjected to higher wall stress during systole than the RCA, resulting in greater endothelial shear stress. This increased stress can disrupt endothelial function and promote lesion formation. Additionally, the anatomy of the heart plays a role: the left ventricular myocardium is anatomically larger and has greater contractile force compared to the right ventricle. Furthermore, the LCA, especially at the branching site of the LAD, undergoes greater torsion compared to the RCA. This torsion can contribute to turbulent flow patterns, which may exacerbate atherosclerosis. Consequently, the LCA and its branches are more frequently involved in coronary circulation disturbances and atherosclerosis compared to the RCA.²⁴

In patient case 2, the culprit lesion involved double-vessel disease with CAD affecting both the LAD and total occlusion of the RCA. According to the study by Fang et al., the culprit lesions in young STEMI patients differ from those in older patients. Specifically, young patients with STEMI are more likely to experience plaque erosion rather than plaque rupture. This phenomenon is predominantly observed in young smokers, as smoking is a known risk factor for plaque erosion, supported by postmortem studies. Plaque erosion is caused by endothelial dysfunction or desquamation, followed by thrombus formation, and is often detected in fibrous plaques rich in hyaluronan. Pedicino et al. reported that increased expression of hyaluronidase 2, an enzyme that degrades hyaluronan in peripheral blood vessels, is associated with disturbed blood flow and subsequent degradation of hyaluronan, leading to pro-inflammatory platelet activation and thrombus formation. The expression of hyaluronidase 2 is notably higher in smokers, as evidenced by Optical Coherence Tomography (OCT) studies identifying eroded plaques.²⁵ In the cases observed at RSUD Balaraja, the exact cause of STEMI and the specific type of plaque remain undetermined, requiring further investigation to identify the underlying pathology.

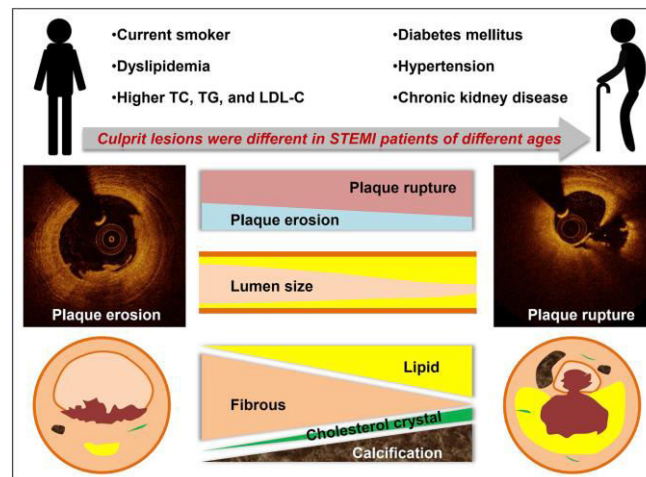


Figure 8. Differences between plaque erosion and plaque rupture in young and old STEMI patients²⁵

4. CONCLUSION

Coronary Artery Disease (CAD) has manifested in young adults, specifically those under 40 years of age. CAD in this younger demographic can be attributed to various factors, notably early-onset atherosclerosis. This is supported by the presence of multiple risk factors for CAD in young patients, including hypertension, dyslipidemia, and lifestyle factors such as high-fat diets, smoking, alcohol consumption, and low physical activity.

In this study, the most dominant risk factors found in the three cases of CAD among young adults at RSUD Balaraja were smoking, hypertension, and dyslipidemia. Angiographic results in these young CAD patients predominantly showed single-vessel disease, with affected coronary vessels including the Left Anterior Descending (LAD) artery and the Right Coronary Artery (RCA). However, further research is necessary to establish a significant relationship between CAD risk factors and the specific location of coronary lesions.

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