

Study the profile of myocardial infarction in young persons

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Abstract:

Background: Globally, cardiovascular disease remains a major cause of adverse outcomes in young individuals, unlike its decline in other age groups. Although coronary heart disease (CHD) primarily occurs in patients over the age of 40, younger men and women can be affected. **Objective:** To study the profile of myocardial infarction in young persons. **Conclusions:** No reflow in young patient with STEMI could be attributed to novel predictors such as Smoking, low EF and AWTMI. This phenomenon was associated with major adverse cardiovascular events and higher mortality.

Keywords: STEMI, percutaneous coronary intervention, no-reflow phenomenon

INTRODUCTION

Globally, cardiovascular disease remains a major cause of adverse outcomes in young individuals, unlike its decline in other age groups. Although coronary heart disease (CHD) primarily occurs in patients over the age of 40, younger men and women can be affected. Most studies have used an age cut-off of 40 to 45 years to define "young" patients with CHD or acute myocardial infarction (MI) ⁽¹⁾ (**Gulati et al., 2020**).

MI in young can be divided in to two groups, those with angiographically normal coronary arteries and those with coronary artery disease (CAD). Some young MI patients have normal coronary arteries. The MI in them can be caused by arteritis, thrombosis, embolisation or spasm. As is the case with venous thrombosis, coronary thrombosis can be seen in hypercoagulable states, such as protein C and protein S deficiency, antiphospholipid syndrome or nephrotic syndrome⁽²⁾ (**Bhardwaj, Kandoria, & Sharma, 2014**).

Coronary artery spasm can cause MI in patients with cocaine abuse and also in association with alcohol binges. In the second group of young MI (those with CAD), it is mostly a result of atherosclerotic process, which starts in early childhood. In a study examined young patients, dying of various causes found that 20% of men and 8% of women in the age group between 30-34 yrs. had evidence of Coronary heart disease (CHD)⁽³⁾ (**Samadova, Madjidova, Sh, Dexqonov, & Safarov, 2021**).

Such diversity of diagnosis and presentation, along with therapeutic implications, underscore the need to study the profile of myocardial infarction in young persons. In addition, these patients have different risk factor profiles, clinical presentations, and prognoses than older patients. All of these factors should be taken into consideration when treating young patients with MI.

I. Risk Factors

The relative risks associated with the traditional risk factors were of similar magnitude as in a group of men aged 40 to 59 years. These included⁽⁴⁾ (**Incalcaterra, Caruso, Lo Presti, & Caimi, 2013**):

- Age – Relative risk 1.63 per six-year increase
- Serum cholesterol – Relative risk 1.92 per 40 mg/dL [1.04 mmol/L] increase
- Systolic blood pressure – Relative risk 1.32 per 20 mmHg increase
- Cigarette smoking Relative risk 1.36 per 10 cigarette/day increase

Young patients with MI usually have multiple risk factors for CHD. In some studies, for example, as many as 90 to 97 percent had one or more traditional risk factors for atherosclerosis.

II. Clinical Presentation

The clinical presentation of CHD in younger patients is different from that in older patients. A higher proportion of young patients do not experience angina, and, in the majority of cases, an acute coronary syndrome that progresses rapidly to MI (most often an ST elevation MI) if left untreated is the first manifestation of CHD⁽⁵⁾ (**Ando et al., 2022**).

These relationships were illustrated in a series of patients with CHD documented by angiography. Patients ≤ 45 years of age had a lower incidence of stable angina than patients ≥ 60 years of age (24 versus 51 percent) and a higher incidence of acute coronary syndromes (76 versus 49 percent). A greater likelihood of complex lesions on arteriography may have contributed to the development of an acute coronary syndrome⁽⁶⁾ (**Sinha et al., 2017**).

Similar findings were noted in another report of patients less than 40 years of age who were referred for cardiac catheterization and angiography. The first manifestation of CHD was angina in 14 percent and acute MI in 69 percent, two-thirds of whom denied chest pain prior to the infarct. Among those who have preceding chest pain, the first episodes often occur only in the week prior to MI⁽⁷⁾ (**Lichtman et al., 2015**).

Table (1): Clinical Presentation of Young Patients With Myocardial Infarction⁽¹⁾
(Gulati et al., 2020).

- Two-thirds present with non-ST-elevation myocardial infarction
- Chest pain characteristics similar to those in older patients
- Women have 5-times higher odds of having myocardial infarction with nonobstructive coronary artery disease
- Look for drug use (cocaine) or source of thromboembolism

- Suspect myocarditis in patients with a history of viral illness who present with worsening heart failure or chest pain

III. Diagnosis of MI in Young Patients

The most common etiology of MI in young individuals is plaque rupture, which is seen in almost 88% to 89% of patients and should be suspected in those who smoke or have hyperlipidemia, diabetes mellitus, or hypertension. They propose a simple diagnostic algorithm that will delineate most causes of MI in young patients⁽¹⁾ (**Gulati et al., 2020**).

Establishing the diagnosis of an acute MI is based upon the typical rise and gradual fall (troponin) or more rapid rise and fall (CK-MB) in biochemical markers of myocardial necrosis with at least one of the following: ischemic symptoms; development of pathologic Q waves on the electrocardiogram (ECG); or ECG changes indicative of ischemia (ST segment elevation or depression)⁽⁵⁾ (**Ando et al., 2022**).

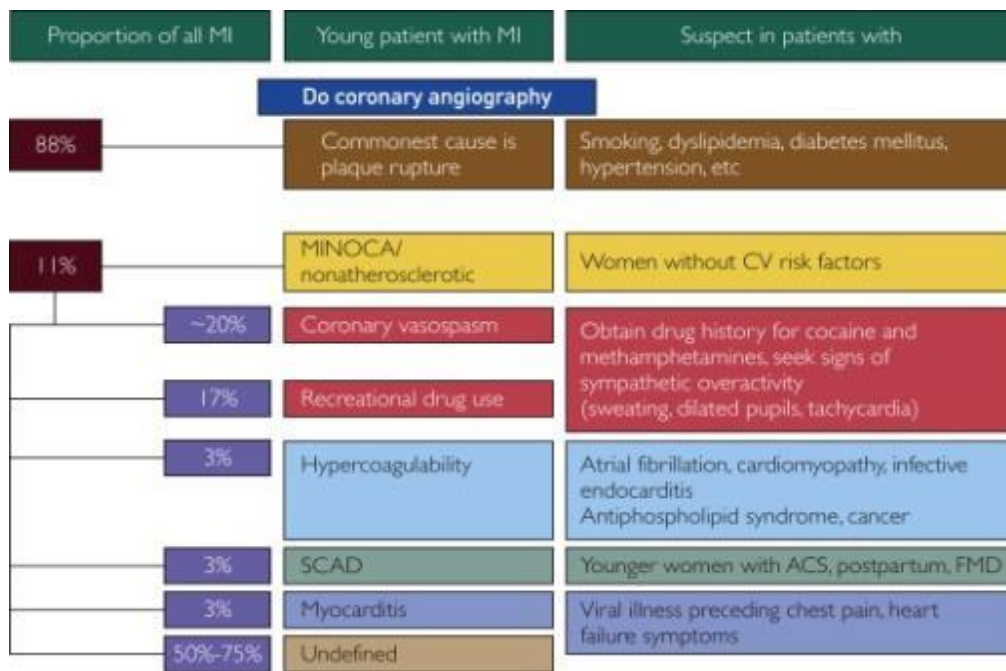


Figure (1): Diagnosis of myocardial infarction (MI) in young individuals⁽¹⁾

(Gulati et al., 2020).

III.1 Spontaneous Coronary Artery Dissection

SCAD should be suspected in younger patients with MI, and diagnosis is confirmed by coronary angiography. Presently, computed tomographic angiography has insufficient sensitivity for SCAD diagnosis⁽⁸⁾ (Tweet et al., 2019).

III.2. Myocarditis

Diagnostic criteria for myocarditis include the presence of one clinical (new-onset/worsening heart failure/ACS) and one diagnostic (electrocardiography, stress test, Holter monitoring, elevated biomarkers, and typical tissue characterization by cardiac magnetic resonance imaging) criterion in the presence of normal coronary arteries (no significant coronary stenosis that exceeds 50% or patients with preexisting CVD). Twelve-lead electrocardiography, echocardiography, and cardiac

magnetic resonance imaging are indicated before endomyocardial biopsy in patients suspected to have myocarditis⁽⁹⁾(Aquaro et al., 2019).

III.3. Coronary Embolism

Coronary embolism is diagnosed with coronary angiography demonstrating angiographic thrombus, concomitant CE in multiple locations/vessels, or evidence of systemic embolization. Patients should be screened for the source of embolic material. Echocardiography is needed to identify left ventricular, left atrial, or appendage thrombus, intracardiac shunt, or a patent foramen ovale. Coronary embolism is frequently associated with systemic embolism, and other sites (eg, abdomen, brain) should be screened⁽¹⁾(Gulati et al., 2020).

III.4. Myocardial Infarction with Non-obstructive Coronary Arteries

To diagnose patients with MI with no obstructive CAD, a good history, physical examination, electrocardiography, measurement of cardiac biomarkers, echocardiography, and coronary angiography with or without left ventricular angiography are needed to identify various causes that fall under the umbrella of MINOCA. Proposed diagnostic criteria for MINOCA include Universal Definition of Myocardial Infarction criteria, nonobstructive CAD on angiography, and no overt cause of similar presentation such as pulmonary embolism or dissection⁽¹⁰⁾ (Scalone, Niccoli, & Crea, 2019).

III.5. Coronary Plaque Disease

For patients with coronary plaque disease, antemortem imaging of plaque characteristics has allowed cardiologists with tools to base their management decisions on plaque characteristics such as the presence or absence of plaque rupture. With the advent of OCT, antemortem diagnosis of plaque erosion is now feasible. It is based on patient demographic characteristics (young, women, minimal cardiovascular risk factors) and the presence of thrombus on angiography and is aided by the absence of plaque rupture on intracoronary imaging⁽¹¹⁾(**Kanwar et al., 2016**).

III.6. Coronary Vasospasm/Microvascular Dysfunction

Coronary microvascular dysfunction reflects an endogenous hyperreactivity and may present de novo, as seen in patients with variant angina, or in the context of exogenous vasospastic stimuli such as the use of stimulants (cocaine, methamphetamine) or can be induced in the cardiac catheterization laboratory with a stepwise increase in the doses of intracoronary acetylcholine or ergonovine . The test results are considered abnormal if the patient's symptoms and/or electrocardiographic changes can be reproduced with significant ($\geq 90\%$) (focal/diffuse) narrowing of epicardial coronary arteries⁽¹⁾ (**Gulati et al., 2020**).

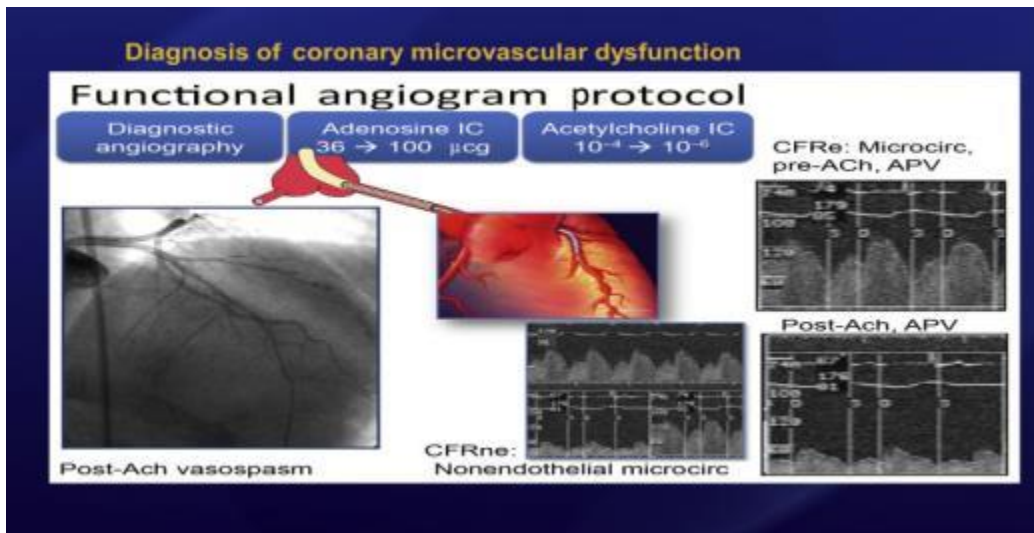


Figure (2): Angiographic protocol for coronary microvascular dysfunction⁽¹⁾

(Gulati et al., 2020)

IV. Management

Management of a young patient with an acute MI varies with type: ST elevation (Q wave) or non-ST elevation (non-Q wave). Risk factor reduction plays a central role in survivors of the MI. This includes smoking cessation; aggressive lipid lowering, and, in appropriate patients, treatment of diabetes and hypertension⁽¹²⁾ (Shah et al., 2016).

ST elevation MI:

Young patients with an acute ST elevation MI should be treated with primary PCI or, if not available, thrombolytic therapy. Prospective randomized trials assessing primary PCI and thrombolytic therapy for an acute ST elevation MI have observed that both young and old patients have a better outcome with PCI than thrombolysis. However, young patients do better than older patients regardless of the therapy received⁽¹³⁾ (Members et al., 2012).

Non-ST elevation ACS:

Patients with a non-ST elevation acute coronary syndrome (non-ST elevation (non-Q wave) MI or unstable angina) are first stabilized with medical therapy and should undergo early coronary angiography and revascularization, if appropriate⁽¹⁴⁾ (**Jackson et al., 2022**).

The efficacy of this noninvasive approach is illustrated by the following observations. One report evaluated patients under 40 years of age who had coronary angiography within 60 days of their first acute MI. Patients without evidence of spontaneous or induced ischemia were compared to those who had ischemia or abnormal stress test after the MI; the two groups were similar with regard to all clinical variables⁽¹⁴⁾ (**Jackson et al., 2022**).

A smaller study also found that exercise testing in the young patient who is asymptomatic after an MI is an effective technique to identify a low risk group. No surgically correctable disease was found in 19 patients who underwent cardiac catheterization for prognosis and were able to reach at least stage 4 on a Bruce protocol exercise test⁽¹⁵⁾ (**Azar & Waters, 2012**).

IV.1. Revascularization

Coronary angiography is generally performed in most of the patients with MI. As discussed previously this probably may not be offered as a routine choice in all the affected patients because of increased chances of finding a normal coronary artery. In patients with risk factors such as diabetes mellitus, dyslipidaemia, and family history of premature CHD, the probability of finding abnormal coronary artery is higher⁽¹⁶⁾ (**Gaudino et al., 2021**).

Coronary angiography should be offered to people with significant left ventricular dysfunction as this group of patients has a better outcome with early revascularisation. In a series of patients with reported coronary artery disease, the prognosis was favourable in the group of patients who received revascularisation treatments like PCI and coronary artery bypass grafting (CABG). PCI in younger patients had fewer post-procedural complications compared with MI rate of 5%, urgent CABG of 1%, and mortality of 1% in the older patients⁽¹⁷⁾(**Lobo et al., 2019**).

In the current era of drug eluting stents and glycoprotein IIb-IIIa inhibitors the success rates are expected to be higher and long term studies are awaited. CABG should be offered to patients with triple vessel disease, complex coronary artery abnormalities, and impaired left ventricular function. CABG carries a better success rate in younger patients⁽¹⁵⁾(**Gaudino et al., 2021**).

V. Prognosis after MI

Myocardial infarction occurring at an early age raises the disturbing potential of a malignant atherosclerotic diathesis and an adverse prognosis. However, as noted above, many such patients do not have severe coronary disease⁽¹⁸⁾(**Zasada et al., 2021**).

In-hospital mortality

The in-hospital mortality in young patients has ranged from 0 to 4 percent, a value lower than that in older patients. This was illustrated in a review of patients with an acute MI: the in-hospital mortality for those aged ≤ 45 years, 46 to 70 years, and >70 years was 2.5, 9, and 21 percent, respectively⁽¹⁸⁾ (**Zasada et al., 2021**).

Long-term outcome

Young patients also have a good long-term outcome after MI. In the large CASS trial substudy mentioned above, survival rates at seven years after an MI were 84 versus 75 percent for young and older men and 90 versus 77 percent for young and older women. The cause of death was cardiovascular in 84 percent of patients, a finding that was not affected by age or gender⁽¹⁹⁾ (**Yunyun et al., 2014**).

Mortality at 15 years was 30 percent overall, but markedly increased in those with prior MI (45 percent), diabetes (65 percent), and left ventricular ejection fraction less than 30 percent (83 percent). The number of diseased vessels in this and another report was not predictive of outcome, because patients with more severe disease were more likely to undergo revascularization⁽¹⁹⁾ (**Yunyun et al., 2014**).

VI. Secondary Prevention

MI in younger patients does carry a better prognosis if appropriately treated. On the other hand, poor control of risk factors carries a significant morbidity and mortality. Antiplatelet agents like aspirin and clopidogrel should be used as per the guidelines for adults. Warfarin is necessary in patients in a hypercoagulable state and continued lifelong in patients with recurrent ischaemic events. Start of β blockers can be delayed for a few days as they may worsen coronary spasm⁽²⁰⁾ (**Egred, Viswanathan, & Davis, 2005**).

Statins are invariably prescribed in all patients with MI and their clinical effects extend beyond lipid lowering. Statins are said to stabilize plaques in patients with atheromatous CHD, thereby improving their outcome, and reducing recurrent events. Other agents like niacin and omega 3 fatty acids should be considered in special situations like hypertriglyceridaemia and low HDL concentrations^(21,22) (**Ma et al., 2019; Toso, Leoncini, & De Servi, 2019**).

Angiotensin converting enzyme inhibitors (ACE-I) should be offered to all patients with left ventricular dysfunction as substantial benefits were shown in using ACE-I in this group of patients⁽²¹⁾(**Ma et al., 2019**).

Lifestyle changes play an important part in the management of these patients. Stopping smoking should be strongly advised. Extensive progression of CHD was noted in younger patients who continue to smoke after their bypass surgery. Good control of diabetes and correction of lipid abnormalities were shown to improve prognosis in patients less than 45 years.⁶⁶ Risk factors modification could prove to be a challenging task in these people⁽²³⁾ (**Huber et al., 2019**).

CONCLUSION:

The no-reflow phenomenon after PCI in young patients with STEMI is predicted by simple clinical and angiographic features, in particular, smoking, previous CAD, low EF, high thrombus burden on baseline angiography and patients who have a large luminal diameter increased risk for no-reflow development, early reperfusion and lesser period can prove to be an important strategy to decrease the incidence of no-reflow.

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