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Myocardial Infarction – Epidemiology for the Current Threat in Young Adults

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ABSTRACT:

Myocardial infarction (MI), traditionally associated with older populations, is increasingly affecting young adults under the age of 45. This emerging trend is driven by a complex interplay of modifiable and non-modifiable risk factors, including smoking, dyslipidemia, hypertension, obesity, sedentary lifestyle, poor dietary habits, obesity, stress, substance abuse, substance abuse, and genetic predisposition. The COVID-19 pandemic has further intensified cardiovascular risks through direct cardiac involvement, increased inflammation, and the exacerbation of unhealthy behaviors during lockdowns. Studies have shown a post-COVID increase in acute coronary events, particularly among young individuals with pre-existing risk factors. Additionally, sex-based differences are evident: approximately 70–80% of young MI cases occur in men, while women, though less frequently affected, tend to experience worse outcomes due to delayed diagnosis and atypical presentation. The psychosocial and economic effects of MI at a young age are profound, often leading to long-term disability and reduced quality of life. Furthermore, symptoms may be atypical or misdiagnosed, delaying appropriate intervention. Raising awareness about early signs and risk factors, promoting heart-healthy behaviors, and implementing targeted prevention strategies are critical to reducing incidence and improving outcomes. This highlights the urgent need for increased awareness, early risk factor screening, and targeted prevention strategies tailored to young populations. Public health initiatives must also address gender disparities in diagnosis and care, especially in the post-COVID era, to reduce the burden of premature cardiovascular disease.

1. Introduction

Coronary Heart Disease (CHD) is a threat in Western nations. The most hazardous and frequently fatal form of CHD is myocardial infarction (MI), which often leads to death (Tsao et al., 2023). Although MI largely strikes adults above 45 years old, it currently strikes even younger adults and both men and women (Sood et al., 2023). Yet, when it happens to younger people, it can lead to serious physical health complications, emotional trauma, and economic burden on the patient as well as the family (Sinha et al., 2002).

The protective effect noticed in the past among young populations is slowly losing its effect because of a rise in shared risk factors among young adults, including smoking, obesity, and an inactive lifestyle. MI is one of the presentations of acute coronary syndrome (ACS), an illness characterized by emergent or transient alteration of cardiac symptoms secondary to compromised blood supply. Thus, MI is the loss of heart muscle cells (infarction) due to ischemic damage that is due to decreased or totally occluded oxygen supply to the cardiac tissue. Compared to unstable angina, another form of ACS (acute coronary syndrome) and Myocardial Infarction (MI) results in irreversible damage to heart cells. This damage is confirmed through elevated levels of cardiac biomarkers, such as troponin, detected in blood tests (Sinha et al., 2002).

Cardiovascular diseases continue to be among the emerging reasons of sickness and mortality in the United States and also globally (Virani et al., 2020). Stroke is especially an emerging reason of long-term dysfunction. While the rate of stroke in the U.S. adults has fallen, one trend is cause for concern: strokes are affecting younger people more and more. In particular, the incidence of stroke among American adults between 20 to 44 years of age increased from 17 per 100,000 in 1993 to 28 per 100,000 by 2015 (Madsen et al., 2020). Strokes among the younger population present serious challenges, as these strokes contribute to physical disability, depression, cognitive impairment, and reduced work productivity—all of which have substantial individual and societal consequences (Yahya et al., 2020).

This disturbing trend is most probably associated with the increasing number of modifiable risk factors among young adults such as high blood pressure, high cholesterol, obesity, and diabetes (Bi et al., 2010). These results highlight the urgent importance of early detection and intensive prevention. Also, rising rates of drug abuse in this group may be adding to the problem. The requirement for specific prevention and involvement of public health along with prevention of the risk factors like hypertension is identified by elevated stroke rate among young African Americans (Bi et al., 2010).

A common disease among the elderly population is coronary artery disease (CAD). Previous studies have set the age of 45 as a mark to categorize acute myocardial infarction (AMI) patients (Gupta et al., 2008). In certain studies, patients aged 35 years and below have been referred to as having "very young" CAD (Puricel et al., 2013). This constitutes a mere 1.5% of all CAD patients (Wolfe et al., 1988). Clinical data from India, however, indicate that the incidence of very young CAD patients is increasing. Surprisingly, most of these young patients have either no or a single risk factor (Dwivedi et al., 2000). In contrast to older patients, stable angina is uncommon among this group; rather, their first symptom is usually a classical MI (Schoenenberger et al., 2011).

The clinical, angiographic, and pathological presentation of AMI in young children is different from that of the elderly. For example, the atherosclerotic plaque rupture that conventionally leads to CAD is not as prevalent in young patients, with referral to other potential causes to be considered (Garoufalis et al., 1998). Sparsity of angiographic results shows that young patients more often have single-vessel CAD, with multivessel disease being comparatively unusual (Gaeta et al., 2000; Gupta et al., 2020).

To explore further, the presentation of AMI in young patients, a cross-sectional study was undertaken by Sricharan et al. in 2012, at Bapuji Hospital, which is attached to J.J.M. Medical College, Davangere, Karnataka, India. From the age group 15-40 years, 49 patients were recruited over a period of two years (Sricharan et al., 2012). The research took account of three principal areas: (1) measurement of risk factors, (2) clinical presentation, and (3) coronary angiographic characteristics. Consecutive sampling according to eligibility criteria was performed on participants. The diagnosis of myocardial infarction was confirmed according to WHO criteria, which necessitated two or more of the following three indicators (Sricharan et al., 2012):

1) Ischemia-consistent chest pain history

2) Serial electrocardiogram (ECG) changes suggestive of MI

3) Raised levels of cardiac biomarkers with a characteristic rise and fall pattern

This review seeks to place MI in young adults in the spotlight as a mounting public health issue, to provoke increased attention from healthcare providers and public health officials. To this end, we summarize existing evidence regarding young adult MI, delving into its epidemiology, etiology, risk factors, outcomes, and potential for early intervention and prevention.

2. Risk Factors

2.1 Obesity

Obesity is an independent and leading cause of cardiovascular diseases, including myocardial infarction (MI). Obesity is a key factor in the pathogenesis of metabolic syndrome, insulin resistance, and chronic systemic inflammation — all of which favor the evolution of atherosclerosis. In India, young adult obesity has increased sharply in the last 20 years, primarily because of changes in lifestyle and diet (Ranjani et al., 2016).

Measures like body mass index (BMI) and central fat patterning have revealed a definite link with early onset of MI. Excess weight substantially increases the risk of MI by further complicating conditions such as high blood pressure, abnormal lipid levels, and glucose intolerance. Sedentary lifestyle patterns consisting of greater intake of high energy processed foods and lower physical activity levels have played a key role in rising obesity levels in the nation. Some research shows that, more than 40% of populace in the age group of 25-44 years in South India are obese or overweight (Jayachandra et al., 2014; Manne et al., 2012). Early onset obesity is particularly risky because it leads to premature onset of atherosclerosis, making early preventive interventions in young generations (Maria et al., 2017). To a greater extent, obesity is seen among younger people with atherosclerotic cardiovascular disease (ASCVD) compared to elderly populations. Observations from the Framingham Heart Study indicate that obesity may be accounting for as many as 15% of cases of coronary artery disease (CAD) in women and 23% in men from middle age (Cole et al., 2003). In individuals below 45 years, obesity might increase the risk of MI up to two to three times (Hales et al., 2018). The recent rise in the prevalence of obesity is specifically alarming, given that it is directly related to the increasing incidence of MI in younger adults (Kayikcioglu et al., 2022; Azar et al., 2012; Wilson et al., 2002).

Research documentation has shown that young obesity is linked to more frequent and serious acute myocardial infarctions (AMI). In past two decades, the percentage of young MI patients suffering from obesity massively increased, highlighting an alarming trend in public health (Yandrapalli, et al., 2019). Again, another study in Cardiovascular Diabetology identifies insulin resistance as the most significant connection between obesity and cardiovascular disease, suggesting that obesity has both direct and indirect effects on cardiovascular outcomes (Tian et al., 2022). An important link between myocardial infarction and obesity has been studied by Zhu et al, 2014 through meta-analysis. It was documented that the need to control the BMI to prevent obesity is essential to avoid the increasing rate of myocardial infarction (Zhu et al., 2014).

2.2 Smoking

Cigarette smoking is the most important risk factor for MI in young adults globally (Yusuf et al., 2004). Among young patients, smoking induces endothelial dysfunction, increased oxidative stress, increases platelet aggregation, and lowers HDL cholesterol. All of these contribute to MI development (Zaheen et al., 2025). One of the studies highlighted that the popularity of smoking and smokeless tobacco among young males contributes heavily to premature coronary events (Gupta et al., 2013). This accounts for about 36% of coronary artery disease cases (Zaheen et al., 2025). Research indicates that smoking was the most common cause of MI (75%) in young adults in Karnataka. Additionally, intake of tobacco is responsible for a significant number of deaths annually in India (Chandregowda et al., 2021; Sriharibabu et al., 2012). Another study observed that smoking accounted for 56.8% of MI cases in individuals aged 18- 44 (Yandrapalli et al., 2019). Furthermore, the study showed that smoking increases MI risk by nine-fold in young men and thirteen-fold in young women (Yandrapalli et al., 2019).

Among patients aged 30 years or younger, 56% reported a smoking history of 20 or more cigarettes per day, while only 10% smoked fewer than 10 cigarettes per day (Shah et al., 2016). It is certain that smoking is the most frequent and modifiable risk factor in young MIs (Shah et al., 2016). Smoking is found in 65 - 92% of young patients with MI and 24% - 56% in MI patients who are old (Gulati et al., 2020; Kayikcioglu et al., 2022).

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2.3 Diabetes

In younger populations, type 2 diabetes mellitus (T2DM) is progressively more diagnosed due to increasing obesity rates and sedentary lifestyles. T2DM accelerates coronary artery disease through glycation end products, microvascular damage, and chronic inflammation (Li et al., 2020; Fishman et al., 2018). Young diabetic patients often have more diffuse and aggressive coronary lesions compared to non-diabetic peers (Tripathi et al., 2021). The prevalence of diabetes among adults below 50 years is 6.5%, with 5.7% being the prediabetic ones. (Li et al., 2020; Fishman et al., 2018).

Diabetes mellitus therefore, significantly increases the risk of cardiovascular diseases, including MI. From cardiovascular related causes, diabetic individuals are two to four times more likely to die compared to non-diabetics (Siam et al., 2024). The combination of hyperglycemia, insulin resistance, and associated metabolic disturbances accelerates atherosclerosis, leads to increased MI risk in young adults (Timon et al., 2014). Young adults with diabetes thus experiences early onset of cardiovascular damage. Studies have shown that diabetes can double or triple the risk of MI, even in young populations (Rawshani et al., 2018).

2.4 Lipid Metabolism

Both primary and secondary dyslipidemia is regularly seen in youths with coronary artery disease (Rubin et al., 2012). In contrast to older patients, especially those with CAD after the age of 60, younger patients (50% of the patients) aged below 40 years have been shown to have higher levels of low-density lipoprotein (LDL) and lower levels of high-density lipoprotein (HDL) (Kayikcioglu et al., 2022; Yang et al., 2020; Rubin et al., 2012; Cengel et al., 2009; Wiesbauer et al., 2009). Notwithstanding of the levels of Low-Density Lipoprotein (LDL) or High-Density Lipoprotein (HDL), higher triglyceride levels are invariably linked with premature atherosclerotic cardiovascular disease (ASCVD). The values of non-HDL cholesterol are also typically raised in myocardial infarction (MI) of young patients (Goliasch et al., 2012).

Another crucial consideration in young-onset cardiovascular disease is Lipoprotein (a), or Lp (a), which contains apolipoprotein (apo)-B. This lipoprotein is homologous structurally to LDL but has one additional plasminogen-like domain, which inhibits fibrinolysis and therefore increases thrombotic risk (Kayikcioglu et al., 2021; Kayikcioglu et al., 2020). Hyper-Lp (a) also serves as a risk factor for premature ASCVD and aortic valve sclerosis. In the young -MI cohort, Singh et al. observed that in one-third of the MI patients younger than age 50, Lp (a) was more than the 80th percentile (Singh et al., 2017). Genetics are the major determinant of Lp (a) levels, with over 90% of variability due to genetic factors (Kayikcioglu et al., 2022). Moreover, the effect of high levels of Lp (a) can also vary among racial groups, with Asian Indians being found with the highest average worldwide (Enas et al., 2019). In addition to those, some additional atherosclerotic and non-atherosclerotic risk factors for the premature development of MI are shown in **Table 1** (Kayikcioglu et al., 2022). The frequency of atherosclerotic factors associated with MI in young is 80- 85% while the frequency of non- atherosclerotic factor is 15-20% (Kayikcioglu et al., 2022).

Table 1. Etiological factors associated with young myocardial infarction.

Atherosclerotic factors (Majorly effective)	**Non- Atherosclerotic factors (Minorly effective)**
Smoking, High Blood Pressure, Diabetes, Obesity	Drug and toxins (Oral contraceptives, cocaine, Anabolic steroids etc.)
Environmental factors like air pollution, socioeconomic status etc	Immune-mediated inflammatory disease (Kawasaki disease, Connective tissue disorders, Giant cell arteritis etc.)
Family history of premature ASCVD	Thrombophilia (Factor V Leiden and Factor II G20210A)

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Dyslipidemias (Familial Combined Hyperlipidemia, Familial Hypercholesterolemia, Elevated Lipoprotein a)	Coronary artery pathologies (Myocardial bridge, hyperhomocysteinemia, Pregnancy etc.)
	Infections (Helicobacter pylori, SARS-CoV-2, Chlamydia, HIV, etc.)

2.5 Thrombophilia

Thrombophilia plays a major role in the development of several medical conditions among young adults. Both inherited and acquired forms of thrombophilia can have a notable effect on this age group (Ceasovschih et al., 2024). One particularly concerning condition is antiphospholipid syndrome, which significantly raises the risk of thrombosis by promoting atherosclerosis (Ceasovschih et al., 2024; Kolitz et al., 2019). It is also a key risk factor for myocardial infarction (MI), especially in young women (Ceasovschih et al., 2024; Takahashi et al., 2024). Clinical data show that antiphospholipid syndrome accounts for about 2.8% to 5.5% of severe myocardial infarction cases in young adults (Kolitz et al., 2019). Additionally, the use of oral contraceptives—particularly when combined with smoking—further increases the risk of thrombotic events in young women (Jang et al., 2021). The Factor V Leiden mutation is also associated with coronary artery ailment in youth, largely due to its role in creating a pro-thrombotic (procoagulant) state.

2.6 Family History

In different studies, it has been established that family history reflects the greater probability of incidence of MI. Due to presence of similar socioeconomic condition, environmental factor, genetic susceptibility, food habit, lifestyle increases the risk of MI for middle aged individual, especially in first- or second-degree relatives (Berentzen et al., 2016). It significantly elevates the risk of early onset of MI in young individuals (Ranthe et al., 2015). For example, due to familial hypercholesterolemia, an autosomal dominant disease has been shown to produce higher amount of LDL cholesterol from birth (Mahoung-Mackonia et al., 2023). Similarly, an individual with first degree relative of venous thromboembolism for prothrombin factor mutation of G20210A can also be associated with increased risk of MI (Poort et al., 1996; Shiffman et al., 2005). Environmental factor & culture of a family also plays a significant role in onset of MI, like, a diet rich in trans-fat, saturated fat is more prone to early onset of MI (Kannel et al., 1964). A study of American College of Cardiology suggests that Mediterranean diet rich in fruit vegetable and whole grain reduces risk of MI (Estruch et al., 2013).

Along with genetic factor shared habits in family like smoking, physical activity, diet can also be associated with increased risk of MI. Studies show that smokers are more prone to MI than non-smokers. In fact, greater cigarette consumption increases the risk of MI especially among women (Millett et al., 2018). Along with that for different cultural and social backgrounds families used to practice different kind of physical activity like household work, sports, exercise which have different types of physiological effect. Lower physical activity can increase the risk of MI (Hummel et al., 2022).

Due to different socioeconomic condition of families, access to healthy food along with medical support is different. Families with lower socioeconomic condition have limited access to healthy food & resources continuous and ignorance to assessment of medical conditions like blood pressure, cholesterol level etc. can elevate the risk of MI (Kaplan et al., 2014). Such families are more prone to have greater exposure to environmental pollutants which also increases the risk of MI (Kaplan et al., 2014). Families with higher socioeconomic condition has higher risk of obesity due to past food habit changes which also elevates the risk of MI (Sonestedt et al., 2005).

2.7 Drug Abuse and Oral Contraceptives

Drug abuse is a well-known and significant factor for early onset and incidence of MI (Lange et al., 2008). Recreational drugs like cocaine, marijuana etc. has significant effect on MI (Mittleman et al., 1999). Use of oral amphetamine, contraceptive & anabolic steroids are well known for elevation of risk of MI (Virmaniu et al., 2007). Immediately after taking cocaine, risk of acute myocardial infarction increases near about 24-fold due to various factors like blocking presynaptic reuptake of norepinephrine and dopamine, coronary vasoconstriction, platelet aggregation etc. Prolonged time cocaine use accelerates atherosclerosis especially among young individuals (Mittleman et al., 1999). On the other hand, marijuana directly effects on cardiovascular system by reducing heart rhythm and rate, changes in blood pressure, vasospasm and vasodilation. It triggers immense inflammation of heart muscle (Alirezaei et al., 2022). Amphetamine group of drugs are widely used as stimulant for central nervous system. These kinds of drugs are known for their effects on increasing catecholamine induced myocardial oxygen demand, platelet aggregation and prothrombotic activation which increases the risk of early occurrence of MI (Sinha et al., 2016).

Anabolic steroids were well known for their immediate relief activity. These drugs are often popular for their activity of enhancing performance of athletes, weightlifter and body builders. These drugs are very popular among young individual but these drugs have prolonged effect on cardiovascular health. Along with increasing stamina and muscle mass these drugs show their effects on platelet aggregation, increasing thrombin activity. It markedly increases troponin activity. These also effects on lipid metabolism by increasing LDL and decreasing HDL. Its increasing popularity among young individuals markedly increases the risks of MI (Samreen et al., 2021).

Oral contraceptives are well known for their effect on birth control. Oral contraceptives are helping to rise serum lipids. It develops carbohydrate intolerance. These effects are more intense for daily smokers. It increases hypertension, coronary thrombosis, diabetes which increases the risk of early incidence of MI (Oliver et al., 1970).

2.8 Outbreak of COVID-19

Coronavirus disease 2019 (COVID-19) has emerged as a global health emergency and was officially declared a pandemic by the World Health Organization in March 2020 (Hu et al., 2021). The clinical manifestations of COVID-19 are diverse, ranging from asymptomatic cases and mild upper respiratory symptoms to severe illness marked by acute hypoxic respiratory failure, which may necessitate mechanical ventilation, along with septic shock and multi-organ failure. COVID-19 can lead to various complications, including those affecting the gastrointestinal, cardiovascular, thromboembolic, and neurological systems. Thrombotic complications are observed in approximately 5–23% of patients (Connors and Levy, 2020). While venous thromboembolism is well documented in COVID-19, arterial thrombosis has also been noted. Although acute myocardial infarction (AMI) has been seen in some COVID-19 patients, these individuals often have pre-existing coronary artery disease or significant cardiovascular risk factors. A recent study in 2023, includes a 27-year male with no previous history of cardio vascular disorder or even no notable risk factors. He developed acute myocardial infarction (AMI) due to the development of thrombus in the right coronary artery post the COVID-19 infection (Zahoor et al., 2023).

2.9 Migraine

Migraine is a major risk factor for the development of MI and other cardiovascular events. Most of the studies evaluated that thrombogenic susceptibility, shared genetic markers and inflammation processes implies the link between migraine and MI. People specifically women with migraine share some common risk factors like hypertension, higher body mass, hypocholesterolemia which are again the major risk factors of MI (Kurth et al., 2016).

2.10 Stress

Stress triggers different kind of adverse physiological and psychological effects (like anxiety and depression) in young individuals, increasing the risk of MI. Several lethal outcomes of stress trigger cardiovascular events like coronary atherosclerosis. In several studies, it has been shown that marital problem, childhood trauma, social isolation, immense work pressure and many more such events are associated with stress (Kahraman et al., 2020). They increase the risk of MI to 40-60%. Stress responses to our endocrine system by hypersecretion of catecholamine and cortisol possess some significant effect on cardiovascular events. Cortisol associates with inflammatory process and variety of diseases. This leads to dyslipidemia, metabolic syndrome and type 2 diabetes mellitus (Kahraman et al., 2020).

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Catecholamine directly effects cardiovascular system along with skeletal muscle and immune system. Prolonged activation of these events can be a major reason for ST segment elevation and early onset of MI (Kahraman et al., 2020). Along with physiological stress, oxidative stress accelerates mitochondrial dysfunction which triggers ROS production. All of these in a summary are the major cause for early onset of MI.

The frequency of risk factors and symptoms versus percentage of MI patients have been shown in **Fig. 1**

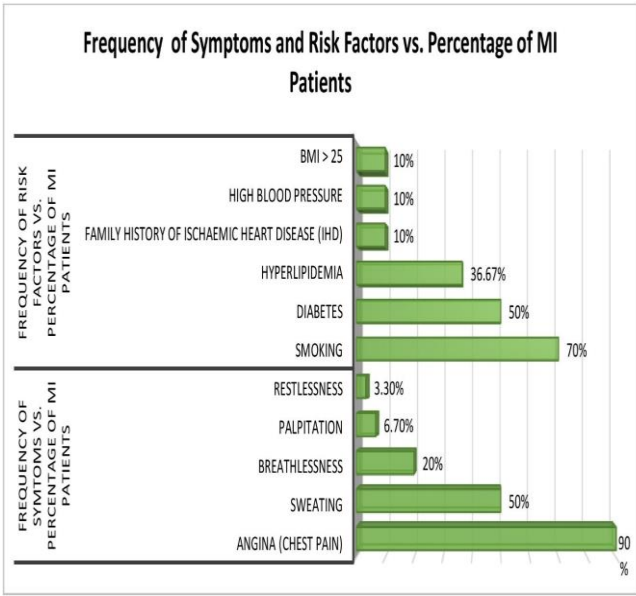

Fig. 1 Frequency of symptoms and risk factors versus the percentage of MI patients

3. The pathology of MI

MI, also referred to as a heart attack, happens when there is a significant reduction in or obstruction of blood flow to the heart muscle, which damages or kills the heart tissue. The main cause of this is coronary artery disease (CAD), in which the arteries' plaques burst, causing thrombus to develop and the vessel to become obstructive. The myocardium's subsequent ischemia (lack of oxygen) sets off a series of events that result in tissue necrosis and cell death. The detailed step wise pathology as well as pathogenesis of MI (Sricharan et al., 2012) has been depicted in **Fig. 2** and **Fig. 3.**

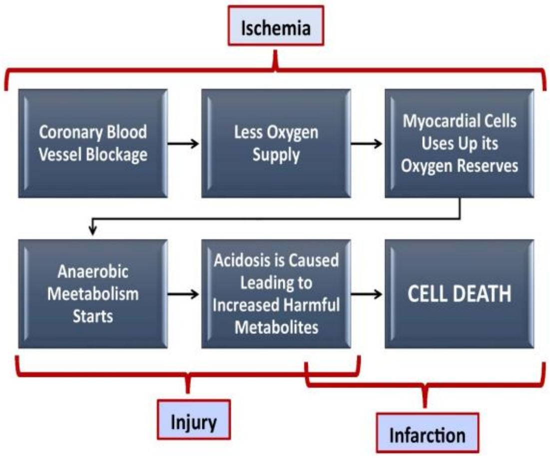

Fig. 2 Detailed step-wise pathology of MI

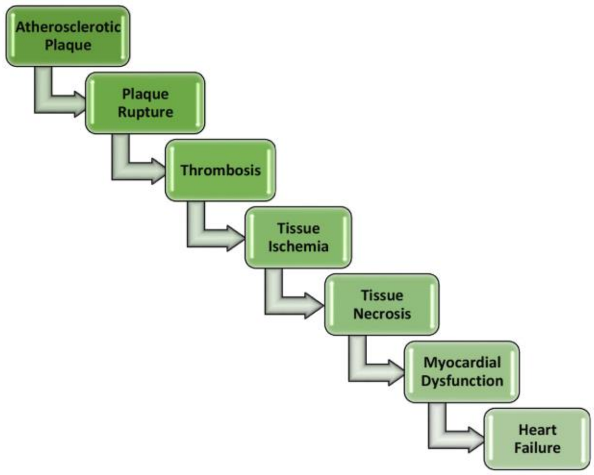

Fig. 3 Detailed step-wise pathogenesis of MI

MI and its pathology in youth shall be categorized as i) MI ascribed to blocked coronaries, type 1 MI ii) MI attributed to non-blocked coronary arteries, or type 2 MI (Gulati et.al, 2020).

3.1 MI type 1 (MI from blocked coronary arteries)

Traditional risk factors such as diabetes, smoking, obesity, hyperlipidemia, and impaired glucose tolerance are precursors of obstructive MI (Gulati et.al, 2020; Krittanawong et.al, 2023; Sood et.al, 2023). As a result, the clinical appearance and plaque progression are more like their older counterpart (Sagris et.al, 2022; Krittanawong et.al, 2023). Younger people are less likely to experience angina symptoms before to MI, albeit (Gulati et.al, 2020). Other non-traditional risk factors for type 1 MI include systemic lupus

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erythematosus, rheumatoid arthritis, psoriasis, pre-eclampsia, early menopause, chronic obstructive respiratory disorders, obstructive sleep apnea, HIV, and polycystic ovarian syndrome (Bandyopadhyay et.al, 2020; Desai et.al, 2023; Gulati et.al, 2020). Antithrombotic and fibrinolytic processes are the focus of therapeutic approaches, according to both recent and earlier research (Kimura et.al, 2019; Chacko et.al, 2020). Acute coronary thrombosis is known to be closely associated with MI (Kimura et.al, 2019). Autopsy investigations indicate that the primary cause of coronary thrombosis is the rupture of the protective fibrous cap of atherosclerotic plaque (Davies, 1996; Krittanawong et.al, 2023). The plaque rupture causes platelet activity and aggression, which in turn triggers thrombus development and inflammatory responses from monocytes and macrophages (Krittanawong et.al, 2023). Second, a coagulation cascade is initiated when macrophages migrate to the afflicted location (Toschi et.al, 1997). A characteristic of arterial thrombosis is the formation of a cross-linkage amongst platelets and a grid of platelets entrapped in fibrin (Risser, et.al, 2022; Chaudhary et.al, 2022), which is caused by the interchange of fibrinogen to fibrin and the liberation of von Willebrand factor due to the activation of platelets.

3.2 MI attributed to non-blocked coronary arteries, or type 2 MI

MINOCA or "Myocardial Infarction in Non-Obstructed Coronary Arteries" is the term used to describe myocardial ischemia alterations in the coronary arteries that do not include obstructive or blocked atherosclerosis. It can be diagnosed through high troponin levels, alike obstructive MI, even if there is no obstructive atherosclerosis. About 1/3rd ST-elevated MI patients (Takahashi et.al, 2024) and 6% of acute MI cases are caused by MINOCA (Takahashi et.al, 2024). It also has the same risk of cardiovascular consequences as obstructive MI, such as heart failure and ischemic stroke (Takahashi et.al, 2024). Critical non-blocked coronary thrombus, SCAD, and CAS are major causes of MINOCA.

3.2.1. Critical non-blocked coronary thrombus

1/3rd of type 2 MI cases is caused by this (Kimura et.al, 2019; Chaudhary et.al, 2022; Khan et.al, 2022). It causes thrombi to develop, which in turn causes peripheral embolism and coronary vascular spasm, ultimately leading to MINOCA (Kimura et.al, 2019; Takahashi et.al, 2024). Plaque disruption, which includes solid calcification, erosion, and rupture, causes acute non-obstructive coronary thrombus (Takahashi et.al, 2024). Different kinds of disruption can be identified by using optical coherence tomography (Khan et.al, 2022).

These plaques can have a variety of shapes and appearances, such as: i) Fluid state mechanism, where blood flow can worsen coronary thrombosis by activating PAI-1 (Sillen & Declerck, 2021). PAI-1 prevents thrombi from accumulating by blocking tissue-type and urokinase-like plasminogen activation (Sillen & Declerck, 2020; Sillen & Declerck, 2021). Patients with diabetes, obesity, and hypertension, where there is a high level of angiotensin II (an increase of PAI-1), also have high levels of PAI-1 (Khalaf et.al, 2019). The concept of vulnerable plaques is based on the fact that elevated levels of PAI-1 create an aspect of the susceptible patient (Gaba et.al, 2023). ii) A significant risk of thrombolysis consequences is indicated by vulnerable or high-risk plaque (Ferraro et.al, 2020). Patients with acute coronary syndrome have been found to have a high prevalence of rupture-prone plaques and widespread inflammation, according to anatomopathological characteristics of these plaques (Hafiane 2019; Ferraro et.al, 2020; Razavi et.al, 2023). This is particularly true for plaques having a bulky lipid mass that does not intrude on the artery wall, a thin fibrous crown, and strong outward remodeling. Even on angiograms, vulnerable plaques are invisible, and they don't induce ischemia until they initiate thrombolysis (Hafiane 2019). Multiple ulcerated plaques, an angiographic requirement for plaque disintegration, are frequently seen in individuals with acute coronary syndrome who have vulnerable plaques (Goldstein et.al, 2000).

3.2.2. Coronary artery vasospasm

The maximum common cause of type 2 MI is CAS (Khan et.al, 2022). The reversible blockage of coronary arteries as a result of elevated vessel constriction of the coronary arteries is the clinical definition (Lin et.al, 2022). MI has increased significantly as a result of CAS (Lin et.al, 2022), and it is very common in Asia, where diffuse constrictions predominate over focal constrictions (Takahashi et.al, 2024; Khan et.al, 2022; Lin et.al, 2022). CAS, which is characterized as transitory myocardial ischemia with abnormal ST-segments and angina symptoms in the presence of non-blocked coronaries throughout the cholinergic provocation test (Khan et.al, 2022; Takahashi et.al, 2024), is brought on by endothelial impairment or abnormality in vascular smooth muscle (Khan et.al, 2022; Lin et.al, 2022; Rehan et.al, 2022). Nitrates are used as angina relievers because endothelial dysfunction arises from a lack of nitric oxide, a vasodilator (Lin et.al, 2022; Rehan et.al, 2022). The Rho-kinase enzyme is the main regulator of hyper-contractility in the context of impairment in vascular smooth muscle. Hemorrhagic shock, oxidized LDL (low density lipoprotein), prolonged hypoxia, inflammatory phenomena, and the buildup of ROS (reactive oxygen species) are some of the factors that might cause it (Rehan et.al, 2022). CAS can be caused by physiological factors like emotional stress (Bandyopadhyay et.al, 2020; Desai et.al, 2023) or pharmacological factors such psychoactive substances (Khan et.al, 2022). Cocaine and other drugs cause spontaneous vasoconstriction of the coronary arteries and activate platelets, which enhances thrombotic activity and promotes hypercoagulability and causes acute myocardial infarction (Rubeis et.al, 2019). Additionally, it increases pacemaker cell depolarization, triggers hypertension, and increases sympathetic activity, all of which have a favorable chronotropic impact (Rubeis et.al, 2019) and exacerbate myocardial ischemia. Cocaine is thought to have a vasoconstrictive effect because it stimulates alpha receptors, which compromises coronary artery perfusion as a result of increased norepinephrine, endothelin synthesis, and reduced nitric oxide generation (Rubeis et.al, 2019). Due to pre-existing endothelial cellular damage, it is most noticeable at atherosclerotic locations, where it results in decreased myocyte function and increased catecholamine release (Rubeis et.al, 2019). Furthermore, mast cells have been discovered in the plaques of long-term cocaine users at autopsy, suggesting a causal role for them in the development and advancement of atheroma (Rubeis et.al, 2019).

3.2.3. Spontaneous coronary artery dissection

The distinctive features of SCAD include intramural hematomas, false lumen formation, and rapturing of the coronary artery wall (Sucato et.al, 2021; D’Amato et.al, 2024). Pregnancy, muscular dysplasia, connective tissue disorders, and hormonal changes are all linked to SCAD, which primarily affects women (Sucato et.al, 2021; D’Amato et.al, 2024). SCAD is seldom identified (D’Amato et.al, 2024) and its real triggering factors are poorly known (Sucato et.al, 2021). An outside-in mechanism and an inside-out mechanism are the two theories regarding the pathophysiology of spontaneous coronary dissection (Matta et.al, 2023). In the inside-out process, an intramural hematoma forms when blood reaches a false lumen created by a rupture in the coronary artery wall. On the other hand, the outside-in process causes bleeding within the artery walls and the formation of intramural hematomas when the vasa vasorum in the artery's outermost layer spontaneously ruptures (Sucato et.al, 2021; Matta et.al, 2023; D’Amato et.al, 2024). Acute myocardial ischemia is brought on by intramural hematomas, which constrict the coronary artery lumen (Sucato et.al, 2021; Matta et.al, 2023; D’Amato et.al, 2024).

3.2.4. Coronary thromboembolism

About 2.9% of people have coronary thromboembolism, with atrial fibrillation being the main cause (Takahashi et.al, 2024; Ceasovschih et.al, 2024). Acute coronary syndrome accounts for 3% of cases (Takahashi et.al, 2024; Ceasovschih et.al, 2024). Individuals who suffer from coronary thromboembolism have a worse prognosis than those who do not have it (Takahashi et.al, 2024). MINOCA of coronary thromboembolism is associated with hypercoagulability, which is caused by congenital factors like factor V Lei den, protein C, and S mutations (Sucato et.al, 2021; Takahashi et.al, 2024; Ceasovschih et.al, 2024).

14% of MINOCA cases are caused by inherited thrombotic abnormalities, especially in young girls (Takahashi et.al, 2024; Ceasovschih et.al, 2024). Athletes frequently utilize anabolic steroids. Their capacity to raise apoprotein B and low-density lipoprotein levels by 20–70% raises the risk of MI and causes disastrous adverse effects at large doses (Sagris et.al, 2022; Ceasovschih et.al, 2024). Not only through erythrocytosis (i.e., a rise in hematocrit by 9.6% over 26 weeks), but also through thrombocytosis, and platelet hyperactivity, androgenic anabolic drugs impact thrombotic processes (Liu et.al, 2019; Sagris et.al, 2022). They also increase homocysteine, fibrinogen, endothelial proteins C and S, and factors VIII and X, all of which affect procoagulant factors (Liu et.al, 2019; Sagris et.al, 2022). Furthermore, anabolic steroids increase the antithrombotic action by decreasing prostacyclin production and fibrinolytic activity (Liu et.al, 2019; Sagris et.al, 2022).

4. Diagnosis of MI

An ECG is an essential diagnostic tool that should be ordered and interpreted by a physician within 10 minutes of admission (Hollander et.al, 1998; Sood et.al, 2023). Coronary angiography should be done right away in individuals who have a high ST elevation on electrocardiography or who may have a new left bundle branch block (BBB). Every patient should be subjected to risk classification and an algorithm for risk-based diagnosis and therapy. The ECG criteria were changed such that they now also consider the patient's age and gender-specific variations in leads V2 and V3. When the J-point is raised by less than 0.15 mV in women, less than 0.25 mV in men under 40, and less than 0.2 mV in men over 40, ST-segment elevations are considered significant (Sood et.al, 2023).

In every other lead, an increase of less than 0.1 mV is diagnostic. ECG interpretation may be difficult for patients with exclusively posterior MI, early repolarization, left or right BBB, prolonged ST elevations from a residual aneurysm, or poorly positioned leads (Sood et.al, 2023). In people with established left BBB, concordant ST elevations might be the best indicator of ongoing AMI. However, more complex algorithms do not appear to provide sufficient diagnostic confidence (Lopes et.al, 2011). Cocaine use is associated with aberrant ECG, which is typically shown as dynamic ST-segment elevation. Suppose that as soon as the patient's chest pain starts, they go to the hospital emergency room. In that instance, an ECG ST elevation might be seen.

The chest pain and ECG abnormalities go away rapidly and can go unnoticed if valuable time is lost. People who have coronary cocaine use-related arterial spasms are prescribed vasodilators (Klein et.al, 1987; Sood et.al, 2023). Patients who experience chest pain for 12 hours are more likely to have aberrant Q waves. Patients with partially blocked coronary arteries exhibit depression, an arbitrary T-wave modification, and an inverted ST wave. Myopericarditis may be evident in lateral leads with concave upward ST-segment elevation and pleuritic discomfort (Lange & Hillis, 2001; Sood et.al, 2023).

4.1 Cardiac Troponin: A Gold Standard Biomarker

The levels of cardiac enzymes are constantly high. The most accurate marker of heart damage is cardiac-specific troponin T increase. The myocardial contractile machinery is regulated by three subtypes of cardiac troponin (T, I, and C). Since only cardiomyocytes express cardiac troponin T (cTnT) or troponin I (cTnI), elevated levels indicate myocardial injury (Shlipak et.al, 1999; Sood et.al, 2023). Within 24 hours, there is an early peak due to biphasic release kinetics, and after 48–72 hours, there is a plateau due to the proteolytic degradation of the contraction apparatus (Katus et.al, 1991; Rempis et.al, 1994; Sood et.al, 2023). Troponin levels that show a clear rise and fall or a significantly elevated level at admission are indicative of acute myocardial infarction (AMI), whereas steady readings across serial tests indicate chronic myocardial damage. A very obvious shift is associated with a higher likelihood of AMI (Sood et.al, 2023).

A previous American National Academy for Clinical Biochemistry Guidance considered a delta change of 20% or more to be significant if initial troponin values are elevated. A committee of the European Society of Cardiology (ESC) recommended a 50% or greater increase or decrease (Sood et.al, 2023). According to the 2015 ESC recommendation on managing non-ST-elevation ACS, the 0-h/1-h rule-in and rule-out algorithms are determined by assay-specific absolute cut-off levels (Sood et.al, 2023). Only when troponin levels are detectable in over 50% of healthy individuals can high-sensitivity assays be considered high-sensitivity (Apple, 2009; Sood et.al, 2023). Cocaine abuse may cause a false-positive creatinine kinase increase in patients (Sood et.al, 2023).

4.2 Echocardiography

Echocardiography also aids in the detection of non-ischemic causes of chest pain, such as aortic dissection, pulmonary embolism, cardiomyopathies, valvular disease, or myocarditis. The preferred method for detecting issues like ventricular wall rupture or subsequent mitral valve regurgitation after papillary muscle rupture or ischemia is echocardiography (Flachskampf et.al, 2011; Sood et.al, 2023).

4.3 MRI

Cardiovascular MRI is very helpful in identifying myocardial disease, despite being less accessible and common than echocardiography (Sood et.al, 2023).

4.4 Coronary Angiography

It provides crucial details on the existence of any anomalies in the coronary artery and, in the event that they exist, the location and severity of the offending lesion (Sood et.al, 2023). Currently recognized diagnostic criteria for MI include an intra-coronary thrombus during coronary angiography, myocardial scarring in MRI or nuclear imaging, or a new regional wall motion anomaly in echocardiography, combined with a notable increase or decrease in cardiac troponin (Sood et.al, 2023).

5. Management and Epidemiology

5.1 Epidemiological Trends

Current evidence reports a consistent increase in MI among adults between 20 and 45 years, particularly in urban Indians. The trend is primarily explained by modifiable lifestyle factors. Evidence from the surveillance of the Global Burden of Disease study indicates rising prevalence of ischemic heart disease in young adults during the past two decades (IHME, 2020). A study from Kerala reported that 22.2% of acute coronary syndrome (ACS) patients were under the age of 50 years. Another study in North India found that anterior wall MI due to left anterior descending artery occlusion was the most common presentation among patients under 30 (Sinha et al., 2017; Dalal et al., 2016). The young MI registry noted an increment in the proportion of subjects younger than 40 years who developed MI at an annual rate of more than 4% to 5% in the past two decades. This is seen more commonly in South Asian groups due to genetic susceptibility and lifestyle factors leading to premature development of coronary artery disease (Weber et al., 2021; Ranjan et al., 2024).

In India, the International Diabetes Federation (IDF) reported in 2021 that around 74 million adults had diabetes, with an increasing percentage below 40 years. The prevalence of "lean diabetes" in Indian youth is defined as normal weight but high visceral adiposity is an alarming feature (Anjana et al., 2015). Additionally, a retrospective analysis by Singh et al. demonstrated that diabetes was noted in close to 20% of Indian patients of young age (<45 years) presenting with acute MI (Sinha et al., 2017).

5.2 Clinical Management

Both acute treatment and long-term secondary prevention are necessary for the effective management of MI in young adults (Sood et al., 2023).

5.2.1 Critical Management of MI

Reperfusion therapy is recommended for every patient who has had ischemic symptoms for less than twelve hours and recurrent ST-segment exaltation. In the span of 120 minutes of diagnosis through ECG, Primary PCI (i.e. percutaneous coronary intervention) can be performed. In case of an inability to perform timely PCI, fibrinolytic therapy must be initiated within ten minutes of STEMI diagnosis after excluding contraindications. If fibrinolysis is provided, and the patient can be transported to a PCI-capable center in 60 to 90 minutes, a planned PCI or rescue PCI should be considered based on the clinical context (Ibanez et al., 2018; Roffi et al., 2016). Fibrinolytic treatment must use fibrin-specific agents like tenecteplase, alteplase, or reteplase, which are highly recommended (Class I) (Ibanez et al., 2018).

Pain and Anxiety Control:

Myocardial infarction chest pain is paralleled by sympathetic nervous activation, leading to vasoconstriction and further burden of the ischemic heart. Intravenous opioids, usually morphine, are generally given for pain relief and are a Class IIa recommendation. For patients with high anxiety, a benzodiazepine, a mild sedative, may be suitable, also on Class IIa advice. Supplemental oxygen therapy is recommended in those patients with low oxygen saturation ($SaO_2 < 90\%$ or $PaO_2 < 60$ mm Hg), and this treatment is a Class I recommendation (Ibanez et al., 2018).

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Nitrate Administration:

In NSTEMI, intravenous nitrates provide superior symptom relief and decrease ST-segment depression compared to sublingual formulations. Dosage needs to be dosed carefully to relieve symptoms, control increased blood pressure in patients with hypertension, and limit undesirable effects such as hypotension and headaches (Roffi et al., 2016).

Use of Beta-Blockers:

Beta-blockers lower the oxygen demand of the heart by decreasing the heart rate, blood pressure, and force of heart contractions. They exert their benefits by preventing beta-adrenergic receptors in the body, including the heart, from responding to circulating catecholamines. Their administration is however contraindicated in patients with suspected coronary artery spasm.

Antiplatelet Therapy:

Aspirin is highly advised (Class I) for both STEMI and NSTEMI presentations. It must be given initially in the loading dose of 150–300 mg (with a non-enteric coated formulation), and then maintain a dose of 75–100 mg daily, irrespective of the treatment approach (Roffi et al., 2016). Aspirin exerts its effect by irreversibly blocking thromboxane A_2 synthesis during the lifetime of the platelet, thus inhibiting platelet aggregation (Patrono et al., 2017).

5.2.2 Some Long-Term Management

Elevated levels of statins are required to lower the low-density lipoproteins (LDLs). Stable atherosclerotic plaques are stabilized by them. High-density lipoproteins are protective. Lifelong aspirin is recommended, and additional drugs depend on the therapeutic intervention performed, e.g., PCI with stenting. Patients having hypertension, systolic left ventricular dysfunction, heart failure, and diabetes are subjected to Angiotensin-converting enzyme (ACE) inhibitors. Beta-blockers are recommended in patients with LVEF less than 40% and without other contraindications. Hypertension may be managed by antihypertensive treatment with the target blood pressure below 140/90 mm Hg. Mineralocorticoid receptor antagonist therapy should be administered to a patient with left ventricular dysfunction (LVEF less than 40%). Glucose-lowering treatment in people with diabetes to achieve current blood sugar targets (Ibanez et al., 2018).

5.2.3 Lifestyle Modifications

Smoking is the most economical secondary prevention of MI. Smoking has a pro-thrombotic effect, which has a very close association with atherosclerosis and MI (Anand et al., 2008). The diet must be saturated fat free with a focus on whole grain foods, vegetables, fruits, and the fish. Recommended level for bodyweight is body mass index of greater than 20 kg/m^2 and less than 25 kg/m^2 and waist circumference of less than 90cm for men and less than 80cm for the women (Piepoli et al., 2016).

6. Awareness and Prevention

Awareness of chest pain was most prevalent, whereas for jaw, back, and neck pain, it was the lowest. The most common signs of a myocardial infarction (MI) include chest pain or discomfort, as well as pain in the arms, left shoulder, elbows, jaw, or back. Other symptoms may involve shortness of breath, nausea or vomiting, and feeling light-headed (Sharma et al., 2021). The prognosis is favorable in MI if reperfusion is obtained promptly after the onset of symptoms. Seeking medical attention early can greatly lower the risk of death and complications associated with delays in care (Sharma et al., 2021). 'Patient delay' refers to the time between the start of symptoms and when medical help is sought. Majority of the patients suffering from MI went to the hospital within three hours after the onset of symptoms, which is the supposed critical period of intervention for cerebrovascular disease (Park 2020). This indicates that awareness of and response to heart disease remains low (Park 2020). In order to enhance the ability of the healthcare system to provide early intervention, it is imperative that the public be informed about the typical symptoms and react accordingly so that patients with a history of pre-existing illness and heart disease and the community-living patients are provided with proper treatment within the critical time in an MI (Park 2020). The time of MI patients from symptom recognition to hospital attendance for treatment was much lesser in men in comparison to women who showed, more passive behavior and attitudes towards symptoms than men (Park 2020). In

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terms of MI symptoms, men grumbled over usual symptoms such as pain in the chest and chills, while women grumbled over unusual symptoms such as pain in the back, jaw, and neck, upper abdomen discomfort, dyspnea, weakness, and loss of appetite (Park 2020).

In global surveys, lack of consciousness of heart attack signs assures a linkage with patient delay and unfavorable health consequences thereafter. Because of the higher risk of CVDs, WHO adopted a 25% target reduction in CVD-related premature death by the year 2025 (Sharma et al., 2021). This begins with main inhibition by communicating CVD risk factors and indication of the diseases to the public, appropriate and timely treatment of cardiovascular events such as severe coronary disorder, and evidence-based secondary deterrence interventions for the mitigation of unfavorable outcomes (Sharma et al., 2021). Knowledge regarding the signs of CVDs and its risk factors is essential to modify the health attitudes, performance, and life practices of an individual (Sharma et al., 2021). For achieving a quick response in case of an MI, one needs to gauge the awareness level of the masses and check whether they are displaying appropriate treatment-seeking behavior (Park 2020). Systematic reviews in the past have ascertained the percentage of the population lacking the knowledge to recognize one risk factor or symptom as ranging from 1.8% among Nigerian hospital workers to a high of 75.1% in a general Ugandan populace.

- **Symptom Recognition and Awareness:** Though precise percentages of MI symptom awareness among Indian youths are scarce, research shows that females tend to present with non-classical symptoms, which results in delays in treatment and diagnosis (Das et al., 2025).
- **Prevalence of Risk Factors:** Diabetes and obesity are more common among young Indian females with MI than among their male counterpart (Bandyopadhyay et al., 2020).
- **Clinical Presentation:** Men tend to present with STEMI more often, while women tend to present with NSTEMI more often, which may show a role in the differing treatment and outcomes (Bandyopadhyay et al., 2020).
- **Treatment Disparities:** Women are less likely to undergo revascularization therapies and experience increased in-hospital mortality than men (Das et al., 2025).
- Every effort should be directed to making sure that women get appropriate and timely interventions, such as revascularization therapies, to minimize mortality rates (Das et al., 2025).

In India, low levels of awareness regarding MI risk and symptoms persist among young people, particularly in low- and middle-income nations. Education at the community level, social media campaigns, and occupational health programs are effective interventions to enhance awareness (Reddy & Gupta, 2019). Knowledge about MI symptoms and the necessity of early treatment is poor among young adults in India. A cross-sectional survey conducted in Chennai showed that 55.4% of respondents did not identify the narrow time window for MI treatment. The information sources were television and the internet, with little contribution from healthcare providers. This indicates the necessity of specific educational interventions to enhance awareness and timely action during MI episodes (Thirumurugan et al., 2023). A cross-sectional survey reported that 5.8% of U.S. adults had no knowledge of any MI symptoms, and 4.5% would not dial emergency services upon an MI episode. This unawareness leads to delayed treatment and poorer outcomes. Public health education and early detection initiatives are necessary to fill this gap (Fang et al., 2019). Online media like YouTube, Instagram, and WhatsApp can spread rapid, evidence-based health messages to younger generations (Kemp et al., 2022).

Diabetes awareness is important for lowering MI risk. Lifestyle change, medication compliance, and early diagnosis can significantly lower cardiovascular complications. Such applications as Diabetes and Aarogya Setu can add cardiovascular risk scores and behavior nudges to raise awareness and screening (Patel et al., 2020). Yet, research indicates that awareness among Indian youth in rural and semi-urban communities regarding the link between diabetes and heart disease is low (Patel et al., 2020).

The preventive measures for MI have been shown in **Fig. 4** (Sricharan et al., 2012). A brief schematic figure

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for the age and gender distribution for young patients having MI have been shown in **Fig. 5** (Sricharan et al., 2012). The prevalence of MI in males and females with respective to few parameters has been tabulated in **Table 2** (Bandyopadhyay et al., 2020).

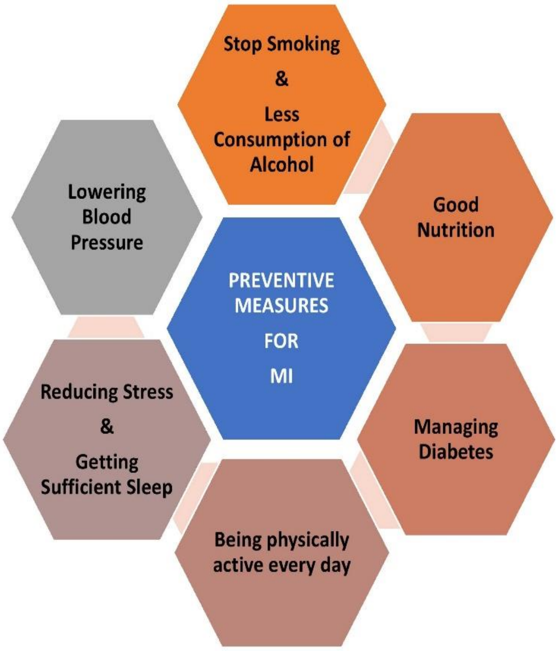

Fig. 4 Preventive Measures for MI

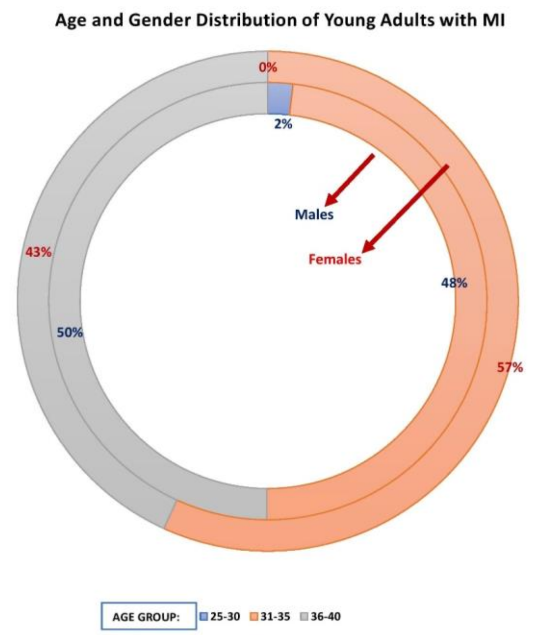

Fig. 5 A brief schematic figure for the age and gender distribution for young patients having MI

Table 2 The prevalence of MI in males and females with respective to few parameters

Parameter	Males	Females
Proportion in young MI patients	86.7%	13.3%
Prevalence of obesity	38.7%	56.9%
Prevalence of diabetes	11.5%	35.4%
Presentation with ST-elevation MI (STEMI)	54.3%	38.2%
Presentation with non-ST-elevation MI (NSTEMI)	45.7%	61.8%
In-hospital mortality	Lower	Higher
Revascularization therapy received	More common	Less common

7. Conclusion

Myocardial infarction (MI) in young adults is a significant and increasingly prevalent health issue that demands urgent attention from healthcare systems, policymakers, and the general public. Traditionally viewed as a disease of older adults, heart attacks are now occurring more frequently in individuals under 45, particularly among males. This shift reflects a broader change in lifestyle and environmental exposures that are contributing to earlier onset of cardiovascular disease.

The causes of MI in young adults are multifactorial, involving both modifiable and non-modifiable risk factors. Modifiable risk factors include tobacco use, poor dietary habits, physical inactivity, obesity, uncontrolled hypertension, dyslipidemia, substance abuse, and high levels of stress. Non-modifiable risk factors, such as a family history of cardiovascular disease or inherited conditions like familial hypercholesterolemia, also play a significant role. Smoking remains the leading cause of MI in young populations, especially among men, while metabolic syndrome and diabetes are becoming more common among young women, increasing their cardiovascular risk.

Awareness among young adults regarding heart attack symptoms and the seriousness of cardiovascular risk factors remains alarmingly low. Many young individuals underestimate their vulnerability, often associating heart disease with aging. This false sense of security leads to delayed diagnoses, neglect of early symptoms such as chest discomfort, fatigue, or shortness of breath, and missed opportunities for timely interventions. Furthermore, the presentation of MI in young adults, especially in women, can be atypical, further complicating early recognition and diagnosis. Women are more likely to experience symptoms such as nausea, indigestion, or back pain, which may be misinterpreted or overlooked, contributing to poorer outcomes compared to men.

Epidemiological data indicate a notable gender disparity in the incidence of myocardial infarction among young adults. Around 70% to 80% of MI cases in this age group occur in men, while women constitute approximately 20% to 30%. However, despite their lower incidence rate, women face a disproportionately higher risk of complications and mortality. Factors such as delayed hospital presentation, under-recognition of risk by healthcare providers, and limited inclusion in cardiovascular research studies contribute to this disparity. This gender gap underscores the importance of improving diagnostic accuracy and tailoring prevention strategies to address sex-specific risk profiles.

The COVID-19 pandemic has added a new dimension to the burden of cardiovascular disease. The virus is known to directly affect the cardiovascular system, potentially triggering inflammatory responses, endothelial dysfunction, and thrombosis, all of which increase the risk of acute myocardial infarction. Additionally, lifestyle changes during lockdowns—such as decreased physical activity, increased stress and anxiety, unhealthy dietary patterns, and disrupted medical care—have further exacerbated existing risk factors among young people. Several post-COVID studies have observed an increased incidence of acute coronary syndromes in younger age groups, with some cases appearing even in individuals without traditional cardiovascular risk factors.

In terms of effects, a myocardial infarction at a young age can be particularly devastating. Beyond the immediate physical implications—such as reduced cardiac output, heart failure, or arrhythmias—young survivors often face long-term emotional, social, and financial consequences. They may be unable to return to work, struggle with depression or anxiety, and experience reduced quality of life. The lifelong need for medications, lifestyle changes, and regular medical monitoring can place additional burdens on both individuals and healthcare systems.

Given these challenges, prevention and early intervention are critical. Effective strategies must start with education. Increasing awareness about the risk of MI in young adults is essential—not only among the general public but also among healthcare providers who may underestimate the likelihood of heart attacks in younger patients. Community outreach, school-based health programs, and social media campaigns can play a vital role in promoting heart-healthy behaviors from an early age.

Routine screening for cardiovascular risk factors should begin earlier, especially in individuals with a family history of heart disease or other high-risk profiles. Simple interventions such as blood pressure monitoring, cholesterol testing, and BMI tracking can help identify at-risk individuals before symptoms arise. Smoking cessation programs, stress management workshops, nutrition counseling, and physical activity promotion are all evidence-based strategies that can significantly reduce MI risk in young populations.

Policy changes are also necessary to support these prevention efforts. Governments and health organizations must invest in preventive cardiology initiatives, ensure equitable access to healthcare, and support research focused on young adults and women—two groups often underrepresented in cardiovascular studies. Employers and educational institutions can contribute by promoting wellness programs, mental health support, and healthy work or campus environments.

Finally, it is imperative to acknowledge and address the gender gap in both prevention and treatment. Women's cardiovascular health must receive equal attention, with more inclusive research, gender-sensitive diagnostic criteria, and awareness campaigns specifically targeting women. Only by confronting these disparities can we ensure that all individuals—regardless of age or gender—receive appropriate, timely, and effective care.

In a nut-shell, myocardial infarction in young adults is no longer a rarity. Driven by a complex mix of lifestyle, genetic, and environmental factors—further intensified by the COVID-19 pandemic—this condition now represents a growing threat to public health. While men remain more frequently affected, women face greater risks of poor outcomes due to diagnostic and treatment gaps. The effects of MI in youth are long-lasting and profound, extending far beyond the immediate medical event. However, with targeted prevention strategies, increased awareness, early risk factor screening, and gender-sensitive healthcare practices, we can reverse this trend and protect the heart health of future generations.

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