

# Review on Myocardial Infarction Occurs in Young Age

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## ABSTRACT

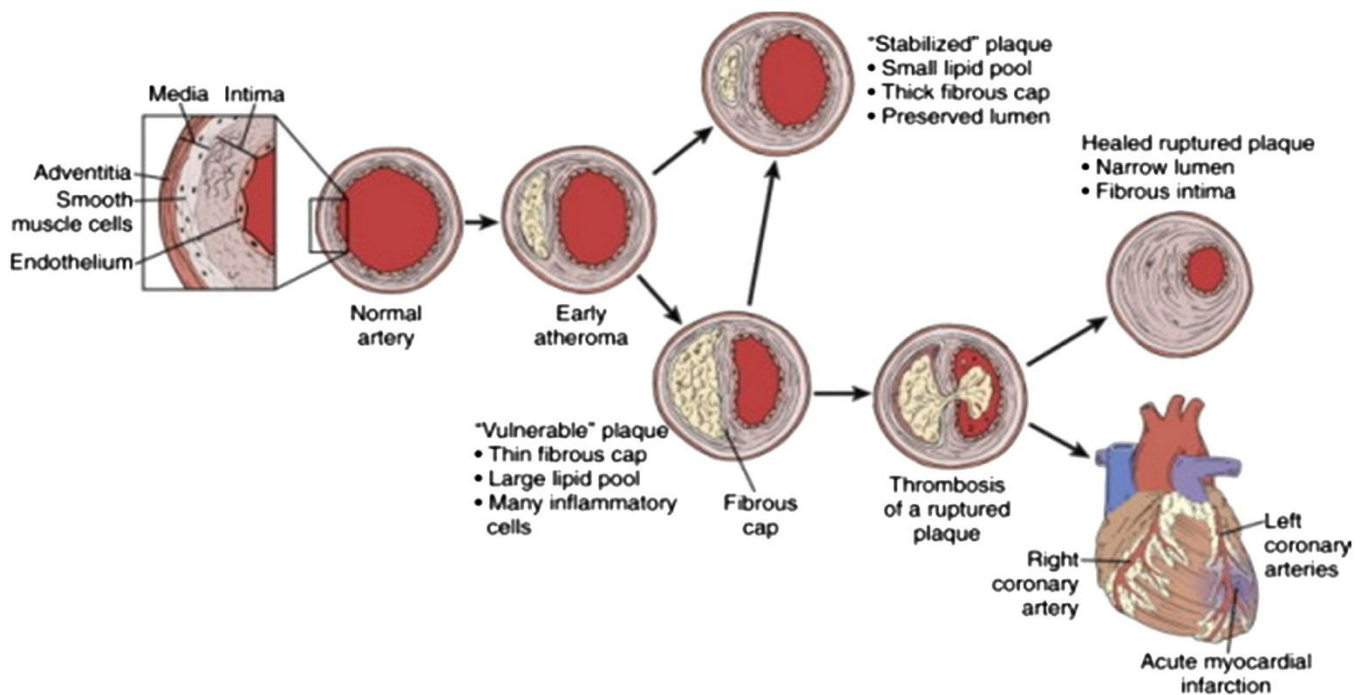
Acute Myocardial infarction may be defined as ischemia in cardiac muscle due to acute lack of blood supply and therefore oxygen supply. Although myocardial infarction primarily affects patients over the age of 45, it can also affect young women and men still when it occurs at an early age. Myocardial infarction, commonly known as a heart attack is the disease of the blood vessels supplying the heart muscle i.e. coronary heart disease. In Patients aged <45 Years This increase is linked to the growing prevalence of traditional cardiovascular risk factors among younger people, such as type 2 diabetes, hypertension, obesity, emerging research points to the influence of led to rise in atherosclerotic CAD. This comprehensive review explores the various etiologies for acute myocardial infarction in young adults and outlines the approach to efficient diagnosis and management for these unique patients phenotypes.

**Keywords:** Myocardial infarction, young adults, risk factors, atheromatous.

## INTRODUCTION

Acute myocardial infarction is may be defined by rapid development of myocardial necrosis due to imbalance between oxygen supply and demand of myocardium. Myocardial infarction has become a significant problem in developed countries. It become an increasingly significant problem in developing countries. In 2019 there were 530,841 death registered in England and Walves of these 55,064(10.4%) were due to ischemic heart disease (IHDS); often referred to as coronary heart disease. This was second leading cause of death in England and Walves, after Dementia and Alzheimer's disease. The age standardized mortality rate (ASMR) for death due to IHDS in 2019 was 96.1 death per 100,000 peoples. The ASMR was significant in England than Walves (94.7 and 109.3 death per 100,000 people). Coronary heart disease is among the biggest killers in country. More than 1.4 million suffer from angina. 300,000 have heart attack every year. More than 110,000 die of heart problems in England every years. The American heart association in conjunction with national institute of health, annually reports the most up-to-date statistics related to heart disease, stroke and cardiovascular risk factors, including core health behaviours and health factors that contribute to cardiovascular health. According to the Indian heart association, india accounts for over 60% of world's heart disease burden despite less than 20% of the global population, with evolving lifestyle pattern and increased stress level lower, the threat is do only expected to grow in 2025. When it occurs at a young age, this illness has serve morbidity, psychological impact and financial burden for patient and his or her relatives. The protection provided to youth has gradually been destroyed by rising prevalence of CHD risk factor in young adults, such as cigarette smoking, increased weight and inactivity. The term MI (Myocardial infarction) describes the loss of cardiac muscle tissue brought by ischemia injury or the deprivation of oxygen to myocardium. The prevalence of CVD (Cardiovascular disease) has also been shown to increase with age in both women and men including prevalence of atherosclerosis, stroke and myocardial infarction. Acute myocardial

infarction remains a significant cause of death worldwide. The incidence of AMI in young patient (<45 years of age) has progressively increased over time. Previously, there had been little focus on the diagnosis, management, and prevention of AMI in young individuals given the low prevalence of this disease. In this study the risk factors, clinical presentation, biochemical parameters, angiographic profiles and short term outcome of myocardial infarction in patients less than 45 years has been studied and compared with the older patients.<sup>(1)</sup> A substantial increase in the prevalence of obesity is being seen especially in young age groups due to nutritional transition. Indian population develop CAD and first myocardial infarction before the age of 40 years is 5 to 10 folds higher. Heart disease, particularly heart attacks, is a growing health concern globally and in India. A heart attack, also known as a myocardial infarction, occurs when the blood flow to a part of the heart muscle is blocked, usually by a blood clot. This blockage can lead to damage or death of the heart muscle cells. The most frequent and high-priority causes of heart attacks in young patients include premature atherosclerosis, familial hypercholesterolemia, substance abuse (especially cocaine and amphetamines), congenital or hereditary conditions (such as hypertrophic cardiomyopathy and coronary artery anomalies), inflammatory conditions (like Kawasaki disease), blood clotting disorders (thrombophilia), obesity/metabolic syndrome, stress-induced cardiomyopathy (Takotsubo syndrome), and other factors, such as oral contraceptive use and physical inactivity. Furthermore, arrhythmias, particularly those associated with sudden cardiac death, often result from conditions, such as hypertrophic cardiomyopathy, congenital coronary artery anomalies, and long QT syndrome. These irregular heart rhythms can disrupt the heart's pumping function, leading to life-threatening situations. Ventricular fibrillation, characterized by chaotic quivering of the heart muscle, is the most common arrhythmia linked to sudden cardiac death. In young individuals, these arrhythmias can be triggered during physical exertion, stress, or even spontaneously, posing a risk of sudden death if not promptly addressed.<sup>(2)</sup> In 2023, the state of Gujarat in India experienced a surge in heart attack emergencies. The Emergency Management and Research Institute (EMRI) reported a 55% increase in heart-related emergency calls compared to the previous year, with 66,397 calls from January to November. The highest number of calls were during October and November, coinciding with the Navratri festival. Tragically, heart attacks claimed 2,853 lives in 2023, with a significant number of victims being between the ages of 11 and 25. This also includes a case of a class 10 student who suffered a fatal heart attack during an exam.<sup>(3)</sup>



**Fig-1 myocardial infarction occurs in young age.<sup>(4)</sup>**

**AIM OF STUDY:-**

To compare risk factors like smoking, diabetes mellitus, hyperlipidemia, obesity, and hypertension in young patients (<45 years) with myocardial infarction in >45 years of age. To assess the angiographic feature of coronary artery disease between the two groups to compare the presence of collaterals in patients with acute myocardial infarction between the younger and older age group. To assess the left ventricular function between the two groups.<sup>(5)</sup>

**A. METHODOLOGY:-**

The present study had a retrospective descriptive design. The code of ethics was obtained from the Research Ethics Committee of Shahid Beheshti University of Medical Sciences in Tehran, Iran (code: IR.SBMU.PHNM.1396.786). Data collection was started in the study setting after obtaining a permission letter from the hospital authorities. The ethical principles were followed in all the phases of the study. Various databases (PubMed, Web of Science, ScienceDirect, Scopus, Embase, and Google scholar search engine) were hired for comprehensive searching. The keywords of “Prevalence”, “Outbreak”, “Burden”, “Myocardial Infarction”, “Myocardial Infarct”, and “Heart Attack” were hired with no time/language restrictions. Collected data were imported into the information management software (EndNote v.8x). Also, citations of all relevant articles were screened manually. The search was updated on 2022.9.13 prior to the publication. Acute myocardial infarction is a common cause of hospitalization and death worldwide. The incidence of AMI varies by country and region, with the higher rates reported in developed countries. According to a study by the World Health Organization, approximately 100 million people worldwide suffer from AMI each year, and around 9 million die from this disease, which in 2019 represented 16% of the total deaths in the world.<sup>(6)</sup> The diagnosis of acute myocardial infarction was based on the universal definition of myocardial infarction and cardiogenic shock was defined. In united state heart disease leading for men, women and people of most racial and ethic groups causing deaths. One person dies in every 34 seconds due to cardiovascular disease. In 2013, (919,032) people died due to cardiovascular disease. That equivalent of 1 in every 3 deaths. We extracted deaths occurring within the United States related to AMI

from the US Centers for Disease Control and Prevention Wide-Ranging Online Data for Epidemiologic Research (CDC WONDER) database. The Multiple Cause-of-Death Public Use record death certificates were used to select AMI-related deaths, which were identified as those with AMI reported anywhere on the death certification either as a contributing or underlying cause of death. AMI-related mortality in young adults was determined using the International Statistical Classification of Diseases and Related Health Problems-10th Revision (ICD-10) codes I21-I22. Young adults as those who were aged 15–44 years at the time of death. This study did not require institutional review board approval given the deidentified nature of the database. <sup>(7)</sup>

### **B. EPIDEMIOLOGY:-**

Cardiac heart disease is becoming less across all age group in the United kingdom. In reality, between 1992 and 2012, the condition was discovered to be present in 0.5% of males and 0.18% of women between the ages of 35 and 44, as well as 20.5% of men and 17.1% of women over age of 60. The incidence and mortality of AMI has been declining less among younger individuals as compared with older individuals. Due to atypical presentations and reluctance to submit themselves for further examination, the number of younger patients may be lower than they are. The ARIC (Artherosclerosis risk with older individuals.) surveillance study examined trends in hospitalization for AMI in the United states across a 20 year span (1995 to 2014). Over this time span, 30% of total AMI were in patients 35 to 54 years of age. The proportion of AMI admissions attributable to young patients increased from 27% in 1995 to 1999 to 32% in 2010 to 2014. In near future, this leads to rise in disease burden. Cigarette smoking is the leading RF for cardiac problems and has been proven to be more and more widespread in young individuals, where it can reach up to 8-10%. In United kingdom, it discovered that girls who smoked more frequently and more extended period had a heavier smoking burden. <sup>(8)</sup> However, the individual risk among patients will vary depending on the mechanism of AMI. While traditional risk factors such as hypertension, cigarette smoking, obesity, hyperlipidemia, and family history of coronary artery disease have been shown to be prevalent in young adults with AMI, there are also nontraditional risk factors such as HIV, systemic lupus erythematosus, and obstructive sleep apnea relevant to patient population. This would effect the protection of heart provided by hormones like estrogen in young women. Increased weight is a significant concern in young people and children, and it has been elevated by three times in the United Kingdom in past 20 years. Autoimmune diseases are also common causes of accelerated atherosclerosis and AMI in young adults. This is driven by chronic inflammation but may be result from secondary factors such as autoimmune medicated renal disease leading to hyperlipidemia or immunosuppressant induced hyperglycemia or hyperlipidemia. The genetics behind AMI are complex but can be simplified into pattern of monogenic versus polygenic expression. Monogenic disease associated with early AMI include familial hypercholesterolemia, homocystinuria, antiphospholipid syndromes. There more complex genes with variable expressivity and interactions with other genes and risk factors that are less well understood and not fully identified. However, the advent of polygenic risk scores may facilitate the identification of patients at risk of AMI at an early age. A polygenic risk score is calculated from set of independent risk variant associated with a specific disease that is based on current evidence from genome wide association studies. Few studies have developed and studied polygenic risk score of AMI found higher score to be significantly associated with early AMI. The American Heart Association, through its Statistics Committee, continuously monitors and evaluates sources of data on heart disease and stroke in the United States to provide the most current information available in the annual Statistical Update. The 2021

Statistical Update is the product of a full year’s worth of effort by dedicated volunteer clinicians and scientists, committed government professionals, and American Heart Association staff members.<sup>(9)</sup>

**4.RISK FACTORS AND CAUSES OF MYOCARDIAL INFARCTION :-**<sup>(10)</sup>

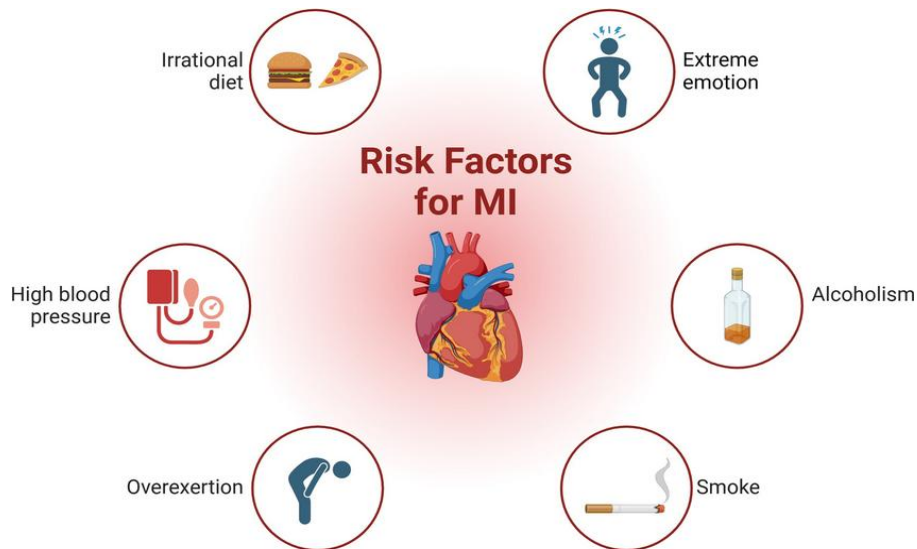
Cigarette smoking, cholesterol level, diabetes, hypertension, increases weight, food habits, physical inactivity, and alcohol consumption were all considered RF.

**I. Conventional risk factors:-**

- Smoking
- Hypertension
- Diabetes mellitus
- Obesity
- High Density Lipoprotein
- Cholesterol

**II. Novel atherosclerotic risk factors:-**<sup>(11)</sup>

- High-sensitivity C – Reactive Protein
- Homocysteine
- Fibrinogen and Fibrin D- Dimer
- Lipoprotein



**FIG-2 Irregular Diets which may also cause myocardial infarction:-**<sup>(12)</sup>

**Risk factors you can’t control :-**

- **Age:-** The risk of heart disease increases for men after age 45 and for women after age 55 (or after menopause).
- **Family history of early heart disease:-** You have a higher risk if your father or a brother was diagnosed with coronary artery disease before 55 years of age or if your mother or a sister was diagnosed with coronary artery disease before 65 years of age.
- Infections from bacteria and viruses.

A heart attack may be caused by a complete or partial blockage of a heart (coronary) artery. One way to classify heart attacks is whether an electrocardiogram (ECG or EKG) shows some specific changes (ST

elevation) that require emergency invasive treatment. Your health care provider may use ECG results to describe these types of heart attacks.

- An acute complete blockage of a medium or large heart artery usually means you've had an ST elevation myocardial infarction (STEMI).
- A partial blockage often means you've had a non-ST elevation myocardial infarction (NSTEMI). However, some people with NSTEMI have a total blockage.<sup>(13)</sup>

**Not all heart attacks are caused by blocked arteries. Other causes include:-**

- Coronary artery spasm. This is a severe squeezing of a blood vessel that's not blocked. The artery generally has cholesterol plaques or there is early hardening of the vessel due to smoking or other risk factors. Other names for coronary artery spasms are Prinzmetal's angina, vasospastic angina or variant angina.
- Certain infections. **COVID-19** and other viral infections may cause damage to the heart muscle.
- Spontaneous coronary artery dissection (**SCAD**). This life-threatening condition is caused by a tear inside a heart artery.<sup>(14)</sup>

**A. SMOKING:**

Cigarette smoking is associated with an increased incidence of acute MI. Cessation of smoking significantly reduces this risk over a one- to three-year period with an exponential decline approaching the risk in ex-smokers within five years of cessation. Recent data indicate an immediate reduction in thrombotic events with smoking cessation. A preliminary, oral presentation study (presented by Sargent, Shepard, and Glantz at the 52nd Annual American College of Cardiology Conference in March 2003) reported that a citywide smoking ban in public places over a six-month period in Helena, Montana, reduced the incidence of acute MI by 60% during that time period. Furthermore, pathologic studies of sudden coronary death indicate that CS increased the risk of plaque rupture and acute thrombosis of a lipid-rich, thin-capped atheroma in men; in female smokers, the prevailing mechanism was plaque erosion with superimposed thrombosis. While the link of smoking and CVD is substantiated by epidemiologic studies, the precise mechanisms responsible for this association have not been defined yet. Cigarette smoking is the most puzzling and complex risk factor for CVDs because it is a mixture of chemical compounds that are either bound to aerosol particles or free in the gas phase. It has been estimated that cigarette smoke has over 7,000 chemical compounds from many different classes, including at least 72 carcinogens.<sup>(15)</sup>

**B. HYPERTENSION :-**

History of hypertension is a frequent finding in patients with acute myocardial infarction (AMI) and its recurring association with female sex, diabetes, older age, less frequent smoking and more frequent vascular comorbidities composes a risk profile quite distinctive from the normotensive ischemic counterpart. Antecedent hypertension associates with higher rates of death and morbid events both during the early and long-term course of AMI, particularly if complicated by left ventricular dysfunction and/or congestive heart failure. Essential hypertension is a common human condition. It is thought to come from the interaction of several genetic and environmental factors. In genetic studies involving two large groups of related individuals with high blood pressure from different regions, we found a connection between the angiotensinogen gene (AGT) and hypertension. We showed that certain AGT variants are linked to the disease. We also discovered significant differences in plasma levels of angiotensinogen among hypertensive individuals with different AGT genotypes.<sup>(16)</sup>

**C. DIABETES MELLITUS :-**

In 2019, the European Society of Cardiology (ESC) and the European Association for the Study of Diabetes (EASD) came together to issue guidelines on diabetes, pre-diabetes, and cardiovascular diseases. These guidelines emphasize that anyone with cardiovascular disease should be screened for type 2 diabetes mellitus (T2DM). Additionally, for those with cardiovascular issues complicated by T2DM, it's crucial to manage risk factors comprehensively. This includes keeping blood pressure, serum glucose, and lipid levels in check, following appropriate antiplatelet therapy, and making lifestyle changes. While we've made great strides in managing many of the complications that come with diabetes, acute myocardial infarction remains a leading cause of illness and death among diabetic patients. The unique factors associated with diabetes can promote the buildup of atherosclerotic plaques and increase the risk of blood clots, which in turn heightens the chances of a heart attack. Additionally, autonomic neuropathy can make patients more susceptible to heart attacks and lead to unusual symptoms, complicating diagnosis and delaying necessary treatment. Coronary artery disease is a frequent issue for those with diabetes mellitus. Interestingly, atypical signs of acute coronary syndromes show up more often than the typical ones, which means we need to stay alert. Silent heart attacks are not rare among older diabetics. It's crucial to follow guideline-directed therapies to manage common related conditions like hypertension, dyslipidaemia, and to promote zero-tobacco policies to prevent complications from diabetes. Even with the best management, the risk of complications remains high, which calls for more treatments and careful monitoring. Research shows that coronary artery bypass grafting tends to lead to better long-term results compared to medical revascularization in cases of multivessel coronary artery disease, especially when it involves stenosis of the proximal left anterior descending artery.<sup>(17)</sup>

| Age (years) Group |                            | Diabetes Mellitus |       | Total  | x <sup>2</sup> Value | P-Value |
|-------------------|----------------------------|-------------------|-------|--------|----------------------|---------|
|                   |                            | No                | Yes   |        |                      |         |
| ≤45               | Count                      | 43                | 7     | 50     | 10.9                 | < 0.001 |
|                   | % within Age (years) Group | 86.0%             | 14.0% | 100.0% |                      |         |
| >45               | Count                      | 28                | 22    | 50     |                      |         |
|                   | % within Age (years) Group | 56%               | 44%   | 100.0% |                      |         |

**Figure-3 Relation Between Age Group And Diabetes Mellitus.**<sup>(17)</sup>

there were 7 patients [14%] with diabetes when compared with group 2 which had 22 patients [44%]. There is statistical significance between two groups.

**D. OBESITY:-**

Obesity, which is broadly defined as excess body weight for a given height, remains a continuing global health concern, as it is associated with increased risk of numerous chronic diseases including type 2

diabetes (T2D), hypertension, and cardiovascular disease (CVD). MI should only be used when there is clinical evidence of acute myocardial ischemia and a rise in CTN levels and one or more of the following characteristics must be present:

1. symptoms of myocardial ischemia.
2. new ischemic electrocardiogram changes.
3. development of pathological Q waves.
4. imaging evidence of new loss of viable myocardium or new regional wall motion abnormality in a pattern consistent with an ischemic cause
5. identification of a coronary thrombus through angiography or autopsy.<sup>(18)</sup>

The global obesity epidemic is well established, with increases in obesity prevalence for most countries since the 1980s. Obesity contributes directly to incident cardiovascular risk factors, including dyslipidemia, type 2 diabetes, hypertension, and sleep disorders. Obesity also leads to the development of cardiovascular disease and cardiovascular disease mortality independently of other cardiovascular risk factors. More recent data highlight abdominal obesity, as determined by waist circumference, as a cardiovascular disease risk.

| Age (years) Group |                            | Obesity |       | Total  | x <sup>2</sup> Value | P- Value |
|-------------------|----------------------------|---------|-------|--------|----------------------|----------|
|                   |                            | No      | Yes   |        |                      |          |
| ≤45               | Count                      | 35      | 15    | 50     | 1.09                 | 0.295    |
|                   | % within Age (years) Group | 70.0%   | 30.0% | 100.0% |                      |          |
| >45               | Count                      | 30      | 20    | 50     |                      |          |
|                   |                            | 60.0%   | 40.0% | 100.0% |                      |          |

**Figure-4 Relation Between Age Group And Obesity.**<sup>(19)</sup>

In our study 15 patients [30.0%] in group 1 and 20 [40 %] in group 2 were obese. There was no significant difference between the two groups with regard to obesity ( p value 0.295) . But , the prevalence of obesity is much higher in both this population.<sup>(19)</sup>

**5.PATHOGENESIS OF MYOCARDIAL INFARCTION:-**<sup>(20)</sup>

1. Atherosclerotic CHD
2. Non-Atherosclerotic Coronary Artery Abnormalities

**I. Atherosclerotic CHD:-**

The atheromatous process begins in infancy. In a necropsy examination of 760 young adults who passed away for various reasons, 20% of men and 5% of women had advanced CHD. The pathogenic causes of young people's atherosclerosis were connected to the typical RF that is the same as in adults. Smoking

was linked to atheromatous processes for young patients, according to reports shown to be prevalent up to 92%. Smoking was found to be more in patients under 40 years of age than in those who were beyond 60. Patients who had a MI while they were younger than 45 years old were shown to have higher rates of lipid abnormalities, particularly hypertriglyceridemia and low high-density lipoprotein. In addition to overt diabetes, a 65% prevalence of decreased glucose tolerance was identified in survivors of MI under 45 years old. In younger people, traditional RF is more important. In addition, the development of hyperhomocysteinemia and variable level of lipoprotein-A may have the same clinical effects.<sup>(55)</sup> Atherosclerosis is a hardening of your arteries from plaque building up gradually inside them. Plaque consists of fat, cholesterol and other substances. This plaque buildup limits blood flow.

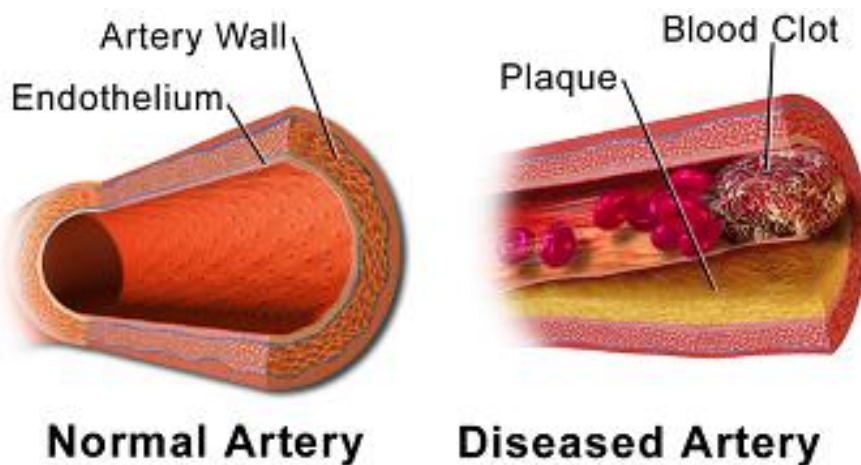


FIG-5 Diagram of Atherosclerotic CHD<sup>(21)</sup>

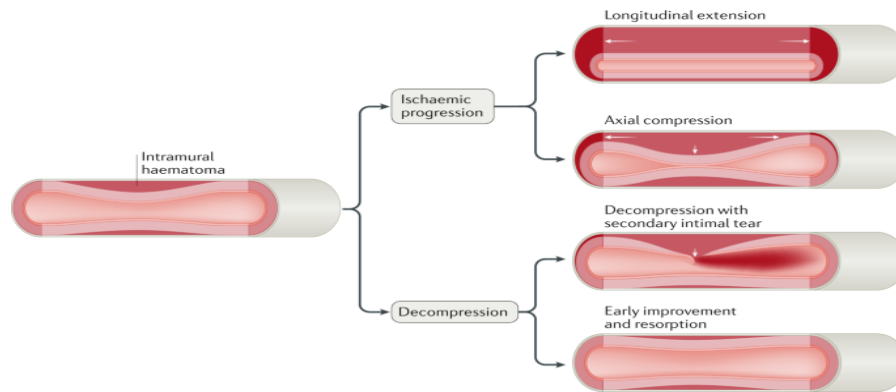
## II. Non-Atherosclerotic Coronary Artery Abnormality:-

Ischemic heart disease is the most common cardiovascular cause of death in women worldwide. Obstructive coronary atherosclerosis is the primary cause of myocardial infarction (MI), however, non-atherosclerotic mechanisms of MI, such as spontaneous coronary artery dissection, vasospasm, microvascular dysfunction, embolization, inflammation, coronary anomalies, infectious and infiltrative causes are increasingly being recognized. Emerging data suggest that women are two to five times more likely to have an MI in the absence of coronary atherosclerosis compared to men, but they continue to remain underdiagnosed and undertreated, partly due to underdiagnosis and limited understanding of these mechanisms. Recent advancements in invasive and non-invasive imaging techniques and physiological testing allow for distinguishing these mechanisms from each other, providing a definitive diagnosis and tailored treatment. This review summarizes the existing literature on the non-atherosclerotic coronary causes of MI with a focus on evidence pertaining to women, offering a basis for future studies.<sup>(22)</sup>

### A. Highlights:-<sup>(23)</sup>

- Myocardial infarction in women remains underrecognized and undertreated, partly due to limited understanding of diverse underlying mechanisms
- Women (versus men) are 2–5 times more likely to have myocardial infarction due to non-atherosclerotic mechanisms
- Advancements in invasive and non-invasive imaging technique may offer insights into precise diagnosis and aid in tailored management

- Optimal management of non-atherosclerotic myocardial infarction remains debated due to limited data, emphasizing the need for further research
- Future studies should elucidate sex-specific differences and the role of novel diagnostic and therapeutic approaches in this patient population.



**Figure - 6 Diagram of Non-Atherosclerotic Coronary Artery Abnormality.<sup>(24)</sup>**

## 6.RECREATIONAL DRUG USE IN MYOCARDIAL INFARCTION:-

New research presented at this year’s ESC Congress 2024 in London, UK (30 Aug – 2 Sept) shows that, among patients admitted to the intensive cardiac care unit (ICCU), those with a recent history of recreational drug use are three times more likely than those with no history to experience a repeat serious cardiovascular event within one year. “Among patients admitted to the intensive cardiac care unit (ICCU), systematic screening for recreational drugs evidenced a significant prevalence – 11% - of recent use,” said study author Dr Raphael Mirailles, Hospital Lariboisiere, Paris, France. “Recreational drug use was associated with triple the risk of a repeat serious cardiovascular event within one year.” Previous work by the same group showed that this recent history of recreational drug use was associated with a higher rate in-hospital outcomes. However, long-term cardiovascular consequences of recreational drug use remain uncertain. In this study the authors aimed to evaluate the prognostic impact of recreational drugs use at 1-year follow-up to predict serious cardiovascular events (including death) in consecutive patients admitted to ICCUs for acute cardiovascular events from the Addiction in Intensive Cardiac Care Units (ADDICT-ICCU) study. All consecutive patients admitted to ICCUs over two weeks in April 2021 at 39 centres across France were included. Screening for recreational drugs use was performed by systematic urinary testing. All patients provided written informed consent for participation and therefore approved urinary testing. One-year follow-up consisted of a clinical visit or direct contact with the patient and the referring cardiologist. The primary composite outcome was the occurrence of a serious cardiac event - cardiovascular death, non-fatal heart attack (MI) or stroke. Subgroup analysis was performed in patients hospitalised at baseline for acute coronary syndrome (non-fatal heart attack / angina lasting more than 20 minutes). The use of cocaine is linked to many cardiac issues, including MI. Cocaine was associated with the clinical presentation in 48% of young patients who were referred to emergency room with the non-traumatic chest discomfort. A though background is essential since cocaine effect might manifest up to 72 hours after consumption. The majority of individuals who misuse cocaine are also chronic smokers, which increases their risk of MI. In addition to MI, cardio-myopathy, tachyarrhythmias, and endocarditis have all been linked to cocaine usage. MI can arise from marijuana and amphetamines. Additionally, excessive

alcohol consumption has been reported to be connected to a young acquiring MI even though the mechanism is not evident.<sup>(25)</sup>

**I.Hyper-Coagulable State:-**

Recurrent arterial and venous thrombosis is linked to the anti-phospholipid syndrome. Young adults in their 30s are frequently affected by it. It could be primary or secondary and connected with autoimmune conditions, such as systemic erythematosus. These often exhibit enhanced platelet adhesiveness and early atherosclerosis. Hypercoagulability or thrombophilia is the increased tendency of blood to thrombose. A normal and healthy response to bleeding for maintaining hemostasis involves the formation of a stable clot, and the process is called coagulation. Hypercoagulability describes the pathologic state of exaggerated coagulation or coagulation in the absence of bleeding. Arterial thrombosis, such as in myocardial infarction and stroke, is different from venous thromboses, such as deep venous thrombosis (DVT) and pulmonary embolism (PE). This activity reviews the cause and presentation of hypercoagulability and highlights the role of the interprofessional team in its management. In young women, prothrombotic factors are associated more with the risk of IS than with MI risk, suggesting a different role of hypercoagulability in the mechanism leading to these two diseases.<sup>(26)</sup>

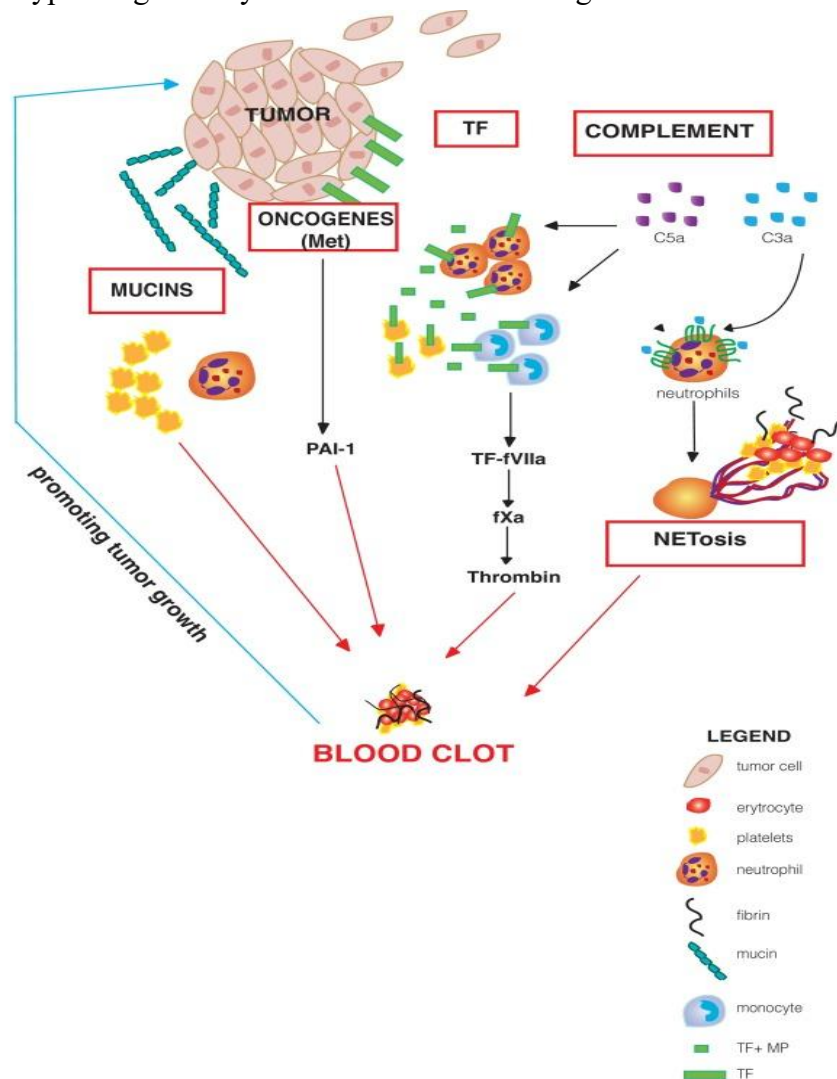


Figure -7 Diagram Related To Hypercoagulable State.<sup>(27)</sup>

## 7. CLINICAL PRESENTATION:-

90% of males and females reported experienced chest pain, such as pressure, tightness, or discomfort. Women had an increased rate of pain symptoms (61.9%) which was not related to chest compared to male (54.9%), which included gastrointestinal distress, evaluated heart rate, and breathlessness. The present study was a hospital based cross sectional observational study and was conducted on 86 patients aged between 18 and 45 years in Department of Medicine and Department of Cardiology, IGMC Shimla from 1<sup>st</sup> May 2019 to 30<sup>th</sup> April 2020.

### I. Inclusion Criteria:-

Non pregnant individuals of age between 18 and 45 years diagnosed with acute myocardial infarction admitted in medicine and cardiology ward.

### II. Exclusion Criteria:-

- Patients not willing to participate in the study.
- Patients of age < 18 years or > 45 years.
- Pregnant females.<sup>(28)</sup>

Informed consent was taken from all the patients. The data including demographic profile of patients and detailed history was collected. History focusing on possible risk factors was taken including history of tobacco smoking, diabetes mellitus, hypertension, positive family history of premature CAD, dyslipidemia and drug abuse. BMI of the patients was calculated. Ten milliliters of venous blood was collected aseptically by venipuncture and transferred aseptically from syringe into sterile vacutainers. High sensitivity Troponin I was done by chemiluminescent micro particle immunoassay. Lipid profile and blood sugar were measured using photometric analysis and glycosylated hemoglobin was measured using high performance liquid chromatography ion exchange method. Nephelometric analysis was used to measure Apolipoprotein A and Apolipoprotein B. Homocysteine levels were measured through chemiluminescence. Twelve lead ECG was done using Heidelco medicore private limited model HE310. Coronary angiography was planned in all the patients, but due to financial and technical issues, it was done in 59 patients. Complications that developed during the hospital stay of the patients were also documented. This prospective study included young (range, 18 to 45 years) patients who presented with acute MI based on clinical evaluation, laboratory investigation, and electrocardiogram, and they underwent a coronary angiography procedure. The present study was a prospective, single-center trial conducted among 1,116 patients. Inclusion criteria were based on diagnosis of STEMI defined by the European Society of Cardiology (ESC)/American College of Cardiology Foundation (ACCF) as

(a) new ST elevation at the J point in  $\geq 2$  contiguous lead of  $\geq 2$  mm in men or  $\geq 1.5$  mm in women in leads V2-V3 and/or of 1 mm in other contiguous chest or the limb leads.

(b) new or presumably new left bundle branch block (LBBB) was considered STEMI equivalent.

Exclusion criteria were:

- (a) patients with prior history of MI, coronary artery bypass graft (CABG) surgery or percutaneous coronary intervention (PCI)
- (b) electrocardiogram (ECG) suggesting bundle branch block or left ventricular hypertrophy
- (c) electrolyte abnormality
- (d) certain conditions influencing ST-segment on ECG (e.g. suspected myocarditis, pericarditis, hypothermia, receiving amiodarone treatment etc.).

Patients subsequently underwent coronary angiography and revascularization by either primary PCI or pharmaco-invasive PCI or CABG surgery after obtaining informed consent with study protocol approved

by Institutional Ethics Committee compelling the principal of Helsinki. This retrospective cohort study reviewed the J-PCI registry data on patients with AMI aged 20-79 years who underwent primary PCI between January 2014 and December 2018. Data on risk factor profiles, clinical features, post-procedural complications, and in-hospital outcomes were reviewed.<sup>(29)</sup>

## **8.HOSPITAL OUTCOMES IN MYOCARDIAL INFARCTION:-**

### **I. METHODS:-**

#### **A. STUDY DESIGN AND POPULATION:-**

The data that support the findings of this study are available from Beijing Anzhen Hospital but restrictions apply to the availability of these data, which were used under license for the current study and so are not publicly available. As a collaborative initiative of the American Heart Association and the Chinese Society of Cardiology, the CCC-ACS project is a national hospital-based registry program for patients with ACS. The project was launched in 2014 and included 159 tertiary hospitals and 82 secondary hospitals from different geographic and economic regions of China, focusing on improving the quality of care. Details on the design and methodology of the CCC-ACS project have been published elsewhere. The National Inpatient Sample databases (2016 to 2020) was queried to identify STEMI admissions as a principal diagnosis using ICD 10 codes. The study population aged 18 to 45 years were divided into cohorts of SMuRF and SMuRF-less based on the presence of  $\geq 1$  risk factor (hypertension, diabetes mellitus, hyperlipidemia and smoking), and in-hospital outcomes were compared. A total of 2737 male patients with AMI were divided into three groups by age:  $< 50$ ,  $50-65$ , and  $\geq 65$  years. Clinical characteristics and long-term results (all-cause and cardiac deaths, nonfatal MI, revascularization, nonfatal stroke, cardiac rehospitalization) were identified across different age subgroups. The association between age and the outcomes was assessed by Cox proportional hazard models. The Yale University institutional review board reviewed the study protocol and granted a waiver of informed consent for the use of this deidentified database. We used Medicare enrollment data from the Centers for Medicare & Medicaid Services (CMS) to identify individuals in the Medicare population aged 65 years or older enrolled in the fee-for-service program for at least 1 month between January 1995 and December 2014. We then linked the fee-for-service population data to the Medicare inpatient claims data to identify patients discharged from an acute-care nonfederal hospital from January 1, 1995, through December 31, 2014, with a principal discharge diagnosis of AMI as determined using International Classification of Diseases, Ninth Revision, Clinical Modification diagnostic codes 410.xx (with the exception of 410.x2). To ensure that patients did not have an AMI in 1995, The study followed the guidelines for cohort studies described in the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for observational studies.<sup>(30)</sup>

#### **B. Patient, Hospital, and County Characteristics:-**

Patient demographic information included age, sex, race (white, black, or other), and dual eligibility status for Medicaid and Medicare. We identified clinical comorbidities that represent additional coexisting illnesses with the method used by CMS to profile hospital 30-day mortality measures for AMI. We restricted the 2011 to 2014 data to the first 10 diagnosis codes to align with the 1995 to 2010 data. Hospital characteristics included hospital structure, patient population, and in-hospital care information. Information about hospital structure was obtained from the 2013 American Hospital Association Surveys, including ownership status, geographic location (urban vs rural), teaching status, Medicare and Medicaid volume, nurse-to-patient ratio, safety-net hospital status (yes vs no), and hospital capacity to provide

CABG surgery. Information about in-hospital care included rates of AMI transfer in and transfer out, rates of in-hospital PCI and CABG procedures, and discharge disposition (rates of discharge to home for self-care, to home with home health care, and to skilled nursing home facilities). Information about the patient population and in-hospital care was drawn from CMS inpatient all-cause claims data. County characteristics included Consumer Price Index–adjusted median income, proportion of people aged 65 years or older, people below the national poverty level and a binary variable to indicate whether a county belongs to a health priority area as defined in one of our previous studies. The average age among participants with hospitalized MI events was 78.3 years (SD 6.7 years) and similar across MI subtypes and ischemic pain presentations. A larger proportion of participants presenting with STEMI without ischemic pain were black women (24 % vs 8 %) or black men (16 % vs 10 %) compared to participants presenting with STEMI with ischemic pain; however, race and sex distributions were similar across ischemic pain presentation for NSTEMI and Unclassified MI. Adjusted for age and event year did not change the distribution of race or sex across MI subtypes or ischemic pain presentation.<sup>(31)</sup>

### C. Ischemic pain presentation:-

Possible ischemic pain in the 72 h prior to the acute MI event, or at the time of an in-hospital event, was categorized as present or absent. Trained medical record abstractors reviewed the full hospital medical record to record if a physician determined that the pain was of cardiac (i.e. ischemic chest pain) or non-cardiac origin. For the present analyses, patients with pain of cardiac origin were classified as MI “with ischemic pain”, and those without pain or with pain of non-cardiac origin (e.g., gastrointestinal) were classified as MI “without ischemic pain” Thus, events classified as “MI without ischemic pain symptom presentation” include definite/probable MI events where patients presented either with no cardiac pain at all, or with cardiac-like pain determined to be of non-cardiac origin. An 8-year retrospective review of Indiana University Hospital records consisting of any patient age 18 to 40 years old who presented with arterial mesenteric ischemia was performed. Three patients were identified that met our criteria. The first patient was discovered to have a protein C deficiency. The second patient was afflicted with afibrinogenemia, a protein C and an anti-thrombin III deficiency. The third patient had been previously diagnosed with Takayasu's arteritis and had an elevated ESR. Each patient had a protracted course of symptoms before mesenteric disease was considered.<sup>(32)</sup>

## 9. METHOD AND MATERIALS IN MYOCARDIAL INFARCTION:-

This is a retrospective study of young adults, presenting with various coronary syndromes at our institute over five year period (2010 to 2015). We used an age of 40 years and less to define young ischemic heart disease. Angiographic registries of patients were analyzed and case files and angiographic records of patients  $\leq 40$  years were studied for presenting symptoms, investigations, diagnosis and angiographic findings. Angiograms showing more than 50% of luminal narrowing were labeled to have significant coronary artery disease. The present study was carried out at the Government General Hospital, Guntur during the period from January 2014 to December 2014. It was a cross sectional study which enrolled the study subjects (below 40 years of age) who meet the inclusion criteria during the study period of one year. The diagnosis of myocardial infarction was based on the WHO criteria, which required at least 2 of the following 3 to be present:

- I. A history of an ischaemic type of chest discomfort
- II. Evolutionary changes on the serially obtained ECG tracings.
- III. Rise and fall of the serum cardiac markers.<sup>(33)</sup>

### 10.DRUG INDUCED MYOCARDIAL INFARCTION:-

A detailed history of illicit drug use is a necessary part of assessment of young individuals with an AMI. The most implicated substances are stimulants such as cocaine, amphetamine, and 3,4-methylenedioxymethamphetamine. Mechanism that leads to cardiac complications with these drugs typically involve vessel damage prothrombotic effects and direct myocardial injury. Diagram on drug induced<sup>(34)</sup>

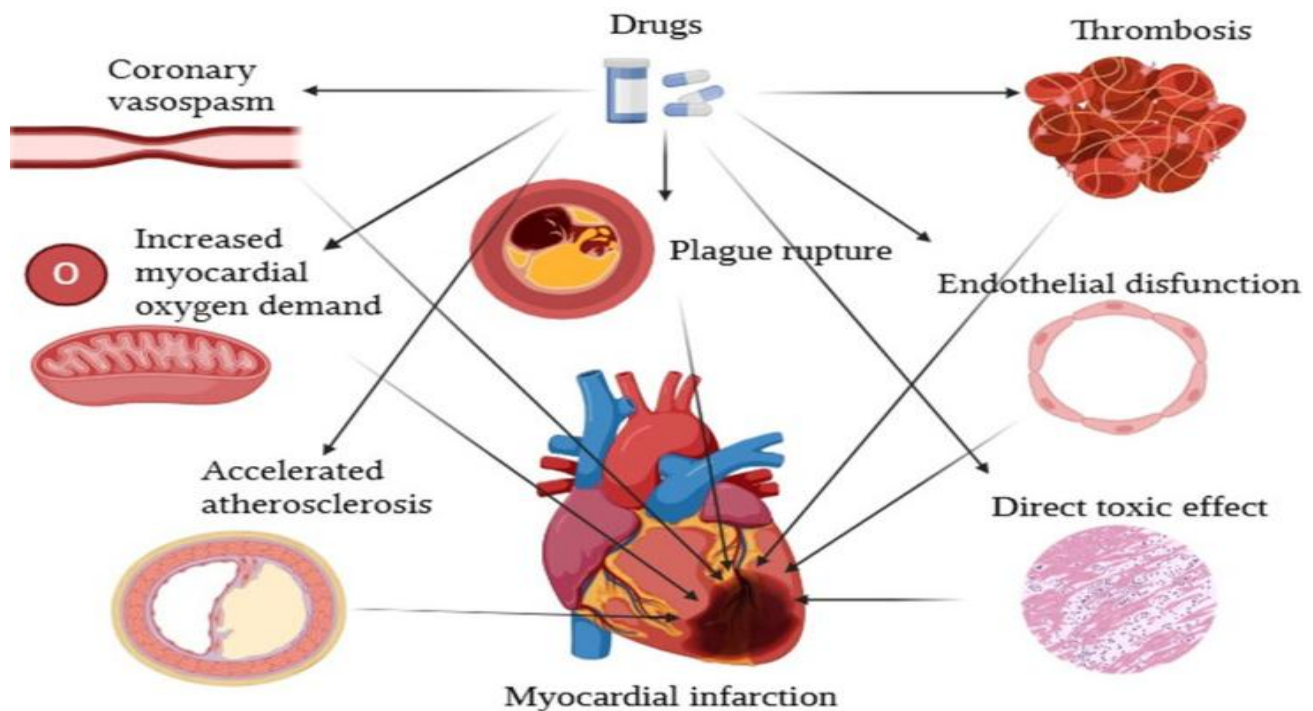


Figure-8 Diagram on drug induced<sup>(34)</sup>

### 11.MANAGEMENT OF MYOCARDIAL INFARCTION:-

Younger patients' first care for MI deviates slightly from typical adult management. All patients should be given first doses of oxygen, nitrates, diamorphine, and aspirin. Statins are also used, which have anti-inflammatory properties. For those patients that have a history of cocaine abuse, beta-blockers should be avoided in them because the chest ache paradoxically becomes worse. Benzodiazepines are recommended for the initial treatment of MI in cocaine abuse. These patients should continue receiving nitrates to prevent coronary spasms. Thrombolytic treatment should be made available to patients with persistent ST elevation due to cocaine that has not improved with the help of nitrates. Younger individuals appear to tolerate thrombolytic drugs better. Risk stratification should be used after the initial management of patients with non-ST-segment elevation MI. Based on persistent or dynamic ECG abnormalities, a greater degree of cardiac increase enzymes, and extra RF such as diabetes mellitus, high-risk patients should be directed to experts so they can determine whether early coronary angiography and intervention are necessary or not. Many younger individuals have normal coronary arteries. Therefore, coronary angiography is not always administered to them. Exercise stress testing is a valuable tool for risk categorization in patients with existing MI. The majority of the young patients who completed stage three of the Bruce regimen (nine minutes or longer) were discovered to have no abnormalities in their coronary arteries. The majority of MI patients often undergo coronary angiography. As was previously noted, due to the greater likelihood of discovering a normal coronary artery, this may not be given as a standard option to every affected

patient. People with severe left ventricular dysfunction should be provided with coronary angiography since early revascularization in the form of percutaneous transluminal coronary angioplasty and coronary artery bypass graft surgery improves their prognosis.<sup>(35)</sup> After myocardial infarction, optimal clinical management depends critically on cardiac imaging. Remodelling and heart failure, presence of inducible ischaemia, presence of dysfunctional viable myocardium, future risk of adverse events including risk of ventricular arrhythmias, need for anticoagulation, and other questions should be addressed by cardiac imaging. Strengths and weaknesses, and timing of the different non-invasive techniques are reviewed for this frequent clinical scenario. When the patient with suspected acute MI reaches the emergency department (ED), The initial evaluation of the patient ideally should be accomplished within 10 minutes of his or her arrival in the ED; certainly no more than 20 minutes should elapse before an assessment is made. On arrival in the ED the patient with suspected acute MI should immediately receive:

- (1) Aspirin, 160 to 325 mg orally. A 12-lead electrocardiogram (ECG) should also be performed. oxygen by nasal prongs.
- (2) Adequate analgesia (with morphine sulphate or meperidine) sublingual nitro-glycerine (unless systolic arterial pressure is less than 90 mm Hg or heart rate is less than 50 or greater than 100 beats per minute [bpm])<sup>(36)</sup>

## 12.CONCLUSION:-

Myocardial infarction is rare in young age under the age of 45 years. But it still be a severe issue for the patient also for the managing physician. It has terrible impact on the young peoples with sedentary lifestyles. A patients age, various RF, clinical manifestations, and prognosis must all be considered. Stratification and early revascularization should be provided since they will produce better clinical results. The increased frequency of CHD and various RF indicates the beginning of alarming trend. In suspected MI patients who are less than 45 years old, abuse of substance, abnormality in coronary artery, premature CAD and hypercoagulable status must be considered.

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