

**MYOCARDIAL INFARCTION IN THE PRE- AND POST-COVID-19 ERA: A REVIEW
OF EMERGING PATHOPHYSIOLOGICAL CHANGES**Udaya Guttikonda^{*1}, V. Srisai², Damavarapu Archana³, Kandukuru Aasritha Varshini⁴, Pachipulusu Harshini⁵,
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India.***Corresponding Author: Udaya Guttikonda**Assistant Professor, Department of Pharmacognosy, Narayana Pharmacy College, Nellore-524003, Andhra Pradesh, India. DOI: <https://doi.org/10.5281/zenodo.19330245>**How to cite this Article:** Udaya Guttikonda^{*1}, V. Srisai², Damavarapu Archana³, Kandukuru Aasritha Varshini⁴, Pachipulusu Harshini⁵, Bacchu Sumana⁶ (2026). Myocardial Infarction In The Pre- And Post-Covid-19 Era: A Review Of Emerging Pathophysiological Changes. World Journal of Pharmaceutical and Medical Research, 12(4), 23–28.
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ABSTRACT

Heart attack (myocardial infarction) takes place when blood flow to the heart is completely or partially blocked (obstructed). Results in necrosis of heart cells and ischemia. The major risk factors for heart attack PRE COVID-19 pandemic including modifiable factors such as hypertension, hyperlipidemia, smoking, diabetes mellitus, obesity, sedentary lifestyle along with non-modifiable factors are age, sex, genetic transfer. Condition such as smoking, hypertension and diabetes mellitus that majorly increase the risk of coronary heart disease and subsequent myocardial infarction. After COVID-19 it is evident that infection will directly or indirectly affects cardiovascular health. This SARS-CoV2 infects heart muscle cells through ACE2 (angiotensin converting enzyme 2) receptors leading to direct effect on myocardial damage, microvascular thrombosis and endothelial dysfunction. Both PRE-COVID and POST-COVID heart attacks (myocardial infarction) has similar ischemic mechanisms but different in triggering the vascular damage and extent of inflammation. For better understanding the long term heart related diseases continued research is necessary.

KEYWORDS

1. Myocardial Infarction
2. SARS-CoV
3. Alpha-CoV
4. Beta-CoV
5. Sedentary lifestyle
6. Angiotensin converting enzyme.

INTRODUCTION

Heart attack, commonly known as myocardial infarction (MI) it occurs by reduced or complete blockage of blood flow to the part of myocardium.^[1] Most of the MI (myocardial infarction) is caused due to coronary heart disorder. In MI (myocardial infarction) condition the flow of blood to the heart is reduced and lack of oxygen supply to the heart occurs. If this continues then heart cells will damage and leads to cell death. At that time patients can feel chest tightness and pressure to arms, neck.^[2] The prolonged ischemia is due to formation of thrombus over an atherosclerotic plaque leading to heart cell membrane rupture, scar formation and necrosis, resulting in heart failure (cardiac dysfunction).^{[2],[3]}

Compared to pre covid post covid mortality rate has been increased to +38%.^[22] As per all records mortality has been increased in post covid at present more deaths occurring due to heart attacks, all age peoples are affected in post covid compared to pre covid.

Pre-covid 19

Pre covid syndromes: Symptoms persisting for months or years after acute infection, including debilitating fatigue, autonomic dysfunction which can last a long time.

Unchangeable risk factors

- family tree

- age
- sex^[19]

Changeable risk factors

- High blood pressure (hypertension)
- Hyperlipidemia
- Cigarette smoking
- Diabetes mellitus
- social factors, emotional factors
- severe obesity
- Poor fruit and vegetable intake
- Sedentary lifestyle
- Drinking habits.^[2]

These listed factors largely contribute to heart attacks.^[2]

Pathophysiology

The acute ischemia in extramural coronary arteries long lasting for 20 to 40 minutes that causes myocardial infarction. The blockage of blood flow usually caused by thrombus that is because of Atherosclerotic plaque found in the coronary arteries. The stoppage of blood to artery that leads to ischemic conditions in myocardium. The ischemia starts to damage the heart cells. It results cell membrane (sarcolemma) breaks down and muscle Fibers (myofibrils) start to relax.^[3] The prior mentioned changes are first microstructural changes in myocardial infarction (MI) process, followed by mitochondrial abnormalities. The continuous ischemia results in coagulative necrosis of heart tissue. The damage starts with deep inside the heart wall (the sub-endocardium) and then spreads outward to the outer layer (sub-epicardium) The outer layer (sub-epicardium) has enhanced collateral circulation, which prolong its life span. Based on the area(region) of heart impacted by infarction, the heart function diminishes. Due to its low regenerative ability of heart muscle, the infected area cures by scar development. Post-infarction remodelling occurs by dilation. Enlargement of healthy heart muscle leading to poor heart performance (or) cardiac dysfunction.^[2]

Smoking

Smoking is one of the major causes for myocardial infarction (illness and deaths). Prolonged and heavy tobacco use, more chances for (CHD) coronary heart disease which causes blockage of blood flow to the heart. Smoking will affect blood flow to the heart in various complicated ways. Tobacco consumption will increase heartbeat and blood pressure (hypertension) and need more oxygen to the myocardium. Smoking will cause blood vessels to constrict and narrow and blood supply to the cardiac muscle is decreased. The combination of cigarette smoking and cocaine will severely affect heart function and reduce oxygen supply to heart muscle and increase need of oxygen this results in the chances of heart attack.^[5]

Hypertension

Hypertension is crucial factor for CHD (coronary heart disease) and MI (myocardial infarction). High blood

pressure gives more stress to heart and blood vessels this will damage the arteries if this continues leads to CHD (coronary heart disease) in which the arteries get blocked and narrowed. This will increase oxygen demand. Prolong high blood pressure may causes heart attack.^[6]

Diabetes mellitus

People with diabetes have more risk for getting CHD (coronary heart disease) heart attack is more common for diabetic people compared to non-diabetic people. Diabetes or high blood sugar level are the major risk factors for death in case of myocardial infarction. Chronic insulin resistance leads to increased blood sugar level. Hence secondary hyperinsulinemia occurs. Reduced insulin sensitivity, high blood sugar level, elevated free fatty acids results in Generalized oxidative imbalance and inflammation. All the prior mentioned factors lead to emergence and atherosclerosis formation in blood cells and small blood vessel damage it leads to heart attack.^[6]

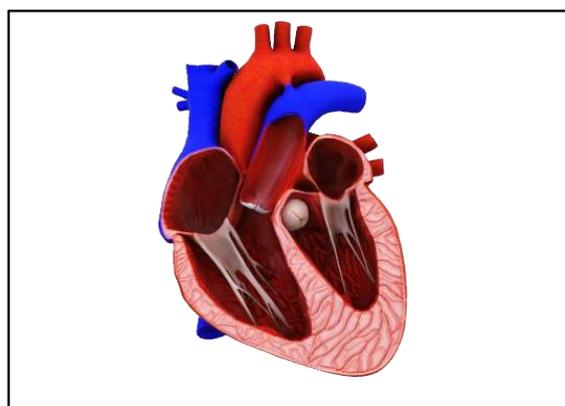


Fig. 1: Diagram of Heart.



Fig. 2: Flow chart of basic Pathophysiology of heart attack.

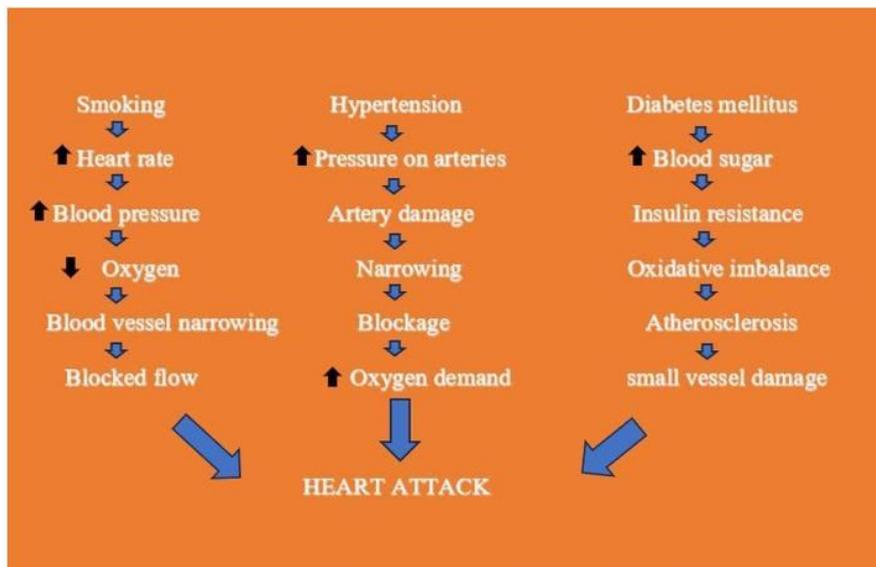


Fig. 3: Flow chart of basic risk factor Pathophysiology of heart attack.

Post covid 19

Post covid syndromes

- Alpha-CoV
- Beta-CoV
- Gamma-CoV
- Delta-CoV^[8]

Pathophysiology

Researchers think that covid 19 cause heart problems in various mechanisms but still studies on it is going on. In that some of the reasons are Cytokine-related tissue damage, Microthrombi, when viruses infect

cardiomyocytes, they can cause direct injury to the myocardium.

- Covid 19 causes severe inflammation in heart due to release of hormone called catecholamines (stress hormone) this inflammation causes broken heart syndrome which leads to heart attack (myocardial infarction).^[39]
- People with Pre-existing heart conditions has chronic inflammation, when infected with covid-19 an additional intense inflammatory response occurs. This extreme inflammation damages the blood vessels. This promotes the formation of

atherosclerotic plaque. this results heart attack and some other cardiovascular complications.^[5,10]

Post-acute sequelae of SARS-CoV-2/COVID-19, including

Cardiovascular Outcomes

• Direct Viral Invasion

One of the main mechanisms of post-acute, COVID-19 cardiovascular injury is direct viral invasion. SARS-CoV2 is capable of infecting both heart and endothelial cells via ACE2 receptors, and this mechanism directly injures the myocardium and vascular endothelium. This leads to structural injury of the Cardiac muscle and tunica intima, with subsequent apoptosis, necrosis, and vascular barrier dysfunction. Consequently, patients may experience myocardial injury that occurs long-term after the acute phase of the infection, with lasting effects of myocardial inflammation, myocardial scarring, and decreased myocardial contractility.^[6,12]

• Lung Complications

Subsequent the acute phase of COVID-19, residual lung complications continues to put considerable stress on the cardiovascular system, exacerbating chronic

cardiopulmonary injury and resultant cardiovascular effects. Conditions such as pulmonary hypertension and decreased gas exchange lead to chronic hypoxia, which stresses the right ventricle to augment circulation. This can lead to right side myocardial failure and additional stress on an already-diseased cardiovascular system. Lastly, hypoxia leads to increased systemic inflammation and oxidative stress thereby leading to a cycle of cardiopulmonary injury.^[4,15,16]

• Cardiovascular Consequences from Acute COVID-19

The combination of viral infection, inflammation, ACE2 dysregulation, pulmonary effects, and the stress of ventilation can lead to a wide array of cardiovascular diseases. The clinical manifestations can encompass coronary artery disease, myocarditis, heart failure as well as thromboembolic events such as pulmonary embolism and deep vein thrombosis. Furthermore, autonomic dysfunction has been noted, with POTS appearing as a common sequela of COVID. Patients who are already at high risk of arrhythmia will also carry arrhythmic risk from structural injury and altered electrophysiologic properties in the myocardium.^[7,17]

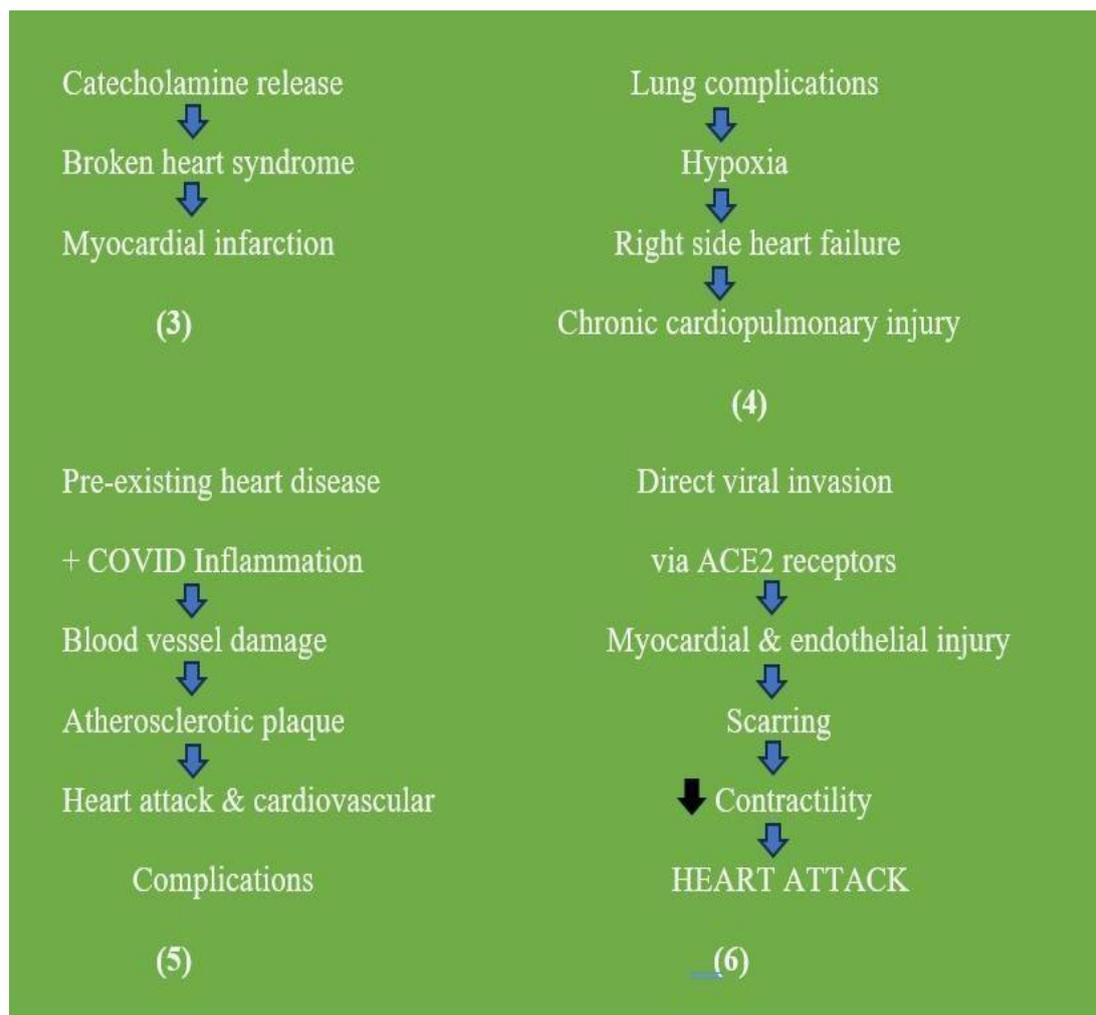


Fig. 4: Flow chart of Post covid heart attack Pathophysiology.

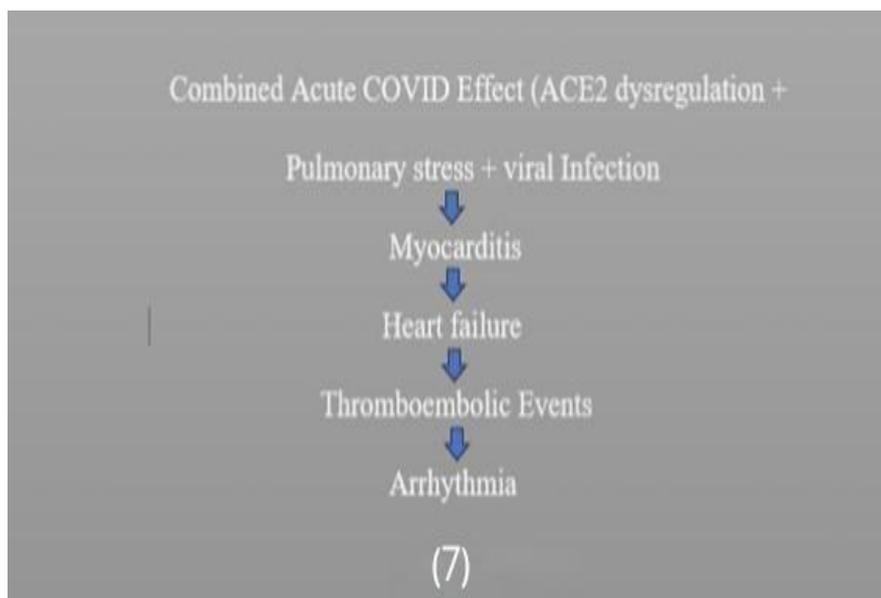


Fig. 5: Flow chart of Post covid heart attack Pathophysiology.

Diagnostic conditions in post covid patients

1. Pulmonary embolism
2. Kidney failure
3. chronic myocardial injury
4. septicemia
5. cardiac shock.^[18]

RESULT

Comparative Analysis of Myocardial Infarction Heart Attack (Heart Attack) Cases and Deaths in India: Pre-COVID vs POST –COVID.

Age Group	Sex	Pre-COVID MI Cases	Post-COVID MI Cases	Change (%)	Pre-COVID Deaths	Post-COVID Deaths	Reference
<45 years	Male	NR	Included in total young ACS (male NR)	+75%	NR	NR	[20]
<45years	Female	180	420	+133%	NR	NR	[20]
45-49years	Male	NR	NR	NR	NR	NR	[21]
≥60 years	Male	NR	NR	NR	NR	NR	[22]
All ages	All	25,418	16,414	-35.4%	NR	NR	[21]
All (PCI)	All	Mortality 1.2-1.4%	Mortality OR≈1.97 higher	↑	NR	Reported ↑	[23]
All (STEMI)	All	799(mortality 5.8%)	410(mortality 8.0%)	+38%	5.8%	8.0%	[22]

Note: NR- Not reported

CONCLUSION

Heart attack is one of the major causes for illness and deaths and immediate medical attention is required. Covid-19 has the significant impact on cardiovascular health, increase in heart attack cases in post covid period compared to pre covid. One of the main reasons for increase in heart attack during pandemic is late treatment. Many people did not reach hospital for treatment because of covid 19 exposure worldwide, so late diagnoses lead to rise in heart attack in post covid period.

Covid 19 is one of the risk factor for heart attack. Heart attacks can be prevented by immediate hospitalization if any symptoms observed and by following the heart-

healthy lifestyle, regular physical activity (walking, running, active in sports), stress management, balanced nutritious diet and by avoiding smoking, alcohol and fast food, junk food. Regular health checkup (heart health) is done and for infected people continued monitoring of cardiac health is important.

Abbreviations

- **COVID-19** – Coronavirus Disease 2019
- **SARS-CoV** – Severe Acute Respiratory Syndrome Coronavirus
- **SARS-CoV-2** – Severe Acute Respiratory Syndrome Coronavirus 2
- **Alpha-CoV** – Alphacoronavirus
- **Beta-CoV** – Betacoronavirus

- **Gamma-CoV** – Gammacoronavirus
- **Delta-CoV** – Deltacoronavirus
- **ACE2** – Angiotensin-Converting Enzyme 2
- **MI** – Myocardial Infarction
- **CHD** – Coronary Heart Disease
- **ACS** – Acute Coronary Syndrome
- **PCI** – Percutaneous Coronary Intervention
- **STEMI** – ST-Elevation Myocardial Infarction
- **OR** – Odds Ratio
- **NR** – Not Reported
- **O₂** – Oxygen
- **POTS** – Postural Orthostatic Tachycardia Syndrome
- **IL-6** – Interleukin-6
- **TNF- α** – Tumor Necrosis Factor-Alpha

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