Ischemic heart Disease (IHD)

Acute coronary syndrome (ACS)

Acute coronary syndrome (ACS) are a spectrum of conditions characterized by acute myocardial **ischemia** or **infarction** due to an **abrupt reduction in coronary blood flow**. ACS is an umbrella term that includes patients who present with either:

A. Unstable angina (UA)

B. or acute myocardial infarction (AMI) [consisting of ST segment elevation myocardial infarction (STEMI) or non–ST segment elevation myocardial infarction (NSTEMI)].

Unstable angina is characterized by rapidly worsening angina, angina on minimal exertion or angina at rest in the absence of myocardial damage.

In contrast MI occurs when symptoms occur at rest and there is evidence of myocardial necrosis, as demonstrated by an elevation in cardiac biomarkers [troponins (I or T) or creatine kinase myocardial band (CK-MB)] that released from the necrotic myocytes into the bloodstream. UA and NSTEMI present without persistent ST segment elevation and are managed differently from STEMI.

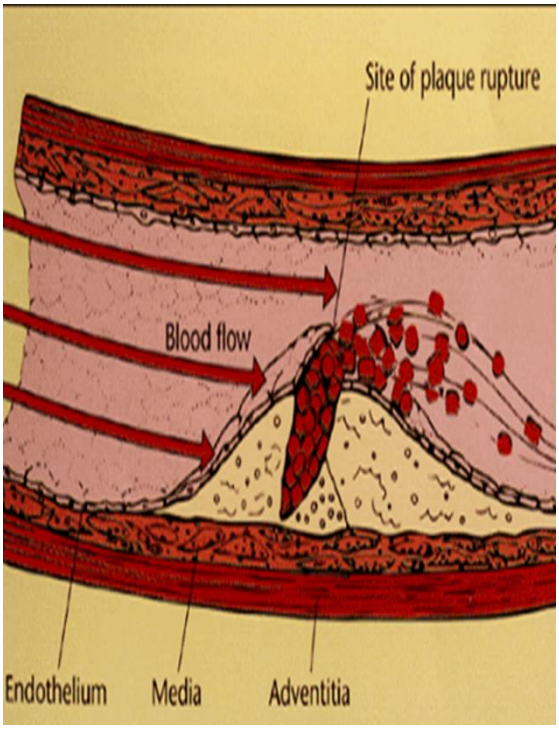
	ST segment elevation	Elevation of cardiac biochemical markers	Extent of Injury
STEMI	Yes	Yes	Myocardial necrosis; total occlusion of coronary artery
NSTEMI	No	Yes	Myocardial injury; partial occlusion of coronary artery
UA	No	No	No myocardial injury; partial occlusion of coronary artery

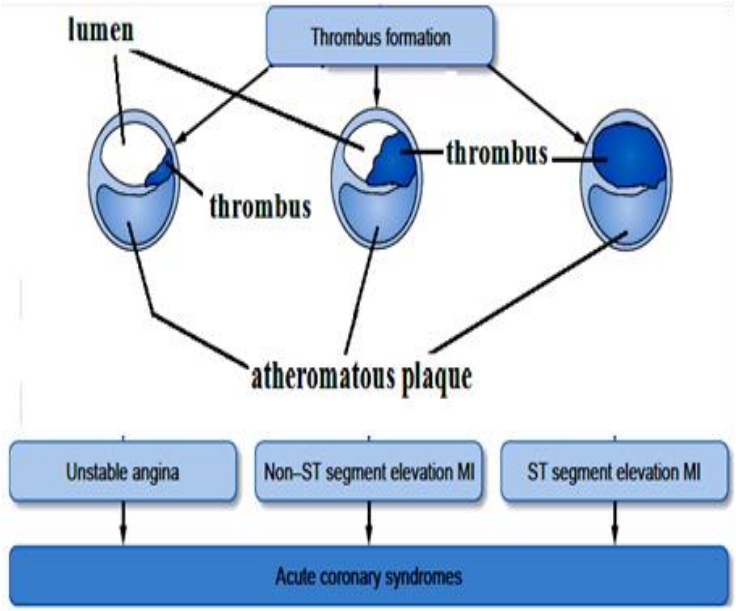
Pathophysiology

A-Plaque Rupture and Clot Formation

The majority of ACS results from occlusion of a coronary artery secondary to thrombus formation. The inciting event is rupture or fissuring of an atherosclerotic plaque, which exposes the blood to thrombogenic lipids and leads to activation of platelet and clotting factors leading to the formation of a clot or thrombus as well as ischemia in the myocardial area.

In patients with UA, the coronary lesion demonstrates little thrombosis. In patients with NSTEMI, there exists partial thrombotic occlusion. For STEMI, there exists total thrombotic occlusion.





Risk Factors

Risk factors for an ACS may be modifiable or nonmodifiable. Nonmodifiable risk factors include age, male gender , and family history. Modifiable risk factors include smoking, alcohol intake, physical inactivity, hypertension, type 2 diabetes, dyslipidemias, obesity.

Clinical Presentation

Central chest pain similar to that occurring in angina is the most common presenting symptoms. Unlike angina it is usually occurs at rest, is more severe and last for longer duration (e.g. some hours). Accompanying symptoms may include nausea, vomiting, diaphoresis, or shortness of breath (SOB) .

Painless or ‘silent’ MI is particularly common in older patients or those with diabetes mellitus (and women). If syncope occurs, it is usually due to an arrhythmia or profound hypotension.

Complications

A-Electrical complications (arrhythmias e.g. VF): The most dangerous time after a myocardial infarction is the first few hours when ventricular fibrillation (VF) is most likely to occur.

B-Mechanical complications (pump failure e.g HF): During a period of days to months after an AMI, ventricular remodeling may occur. It is characterized by left ventricular dilation and reduced pumping function of the left ventricle, leading to cardiac failure.

Diagnosis

A- ECG

B-Biochemical markers

When a cardiac cell is injured; enzymes (cardiac biomarkers) are released into the circulation. Biochemical markers of myocardial cell death are important for confirming the diagnosis of MI.

Troponins T and I are highly specific for myocardial injury and are preferred for the diagnosis of an acute MI. while CK-MB are less specific for MI than troponins

Both troponins and CK-MB are detectable within 6 hours of MI. Troponins remain elevated for 7 to 14 days, whereas CK-MB returns to normal within 48-72 hours.

Desired Outcome

Short-term goals of therapy include:

1) Early restoration of blood flow to the affected artery to prevent infarct expansion (in the case of MI) or prevent complete occlusion and MI (in UA).
2) Prevention of complications and death.
3) Relief of ischemic chest discomfort.

Treatment

The primary strategy for patients with an occluded coronary artery (STEMI) is the restoration of coronary flow with either a fibrinolytic agent or percutaneous coronary intervention (PCI). If the coronary artery is patent (UA and NSTEMI), then fibrinolysis is unnecessary and probably harmful, although PCI may still be appropriate.

A-Nonpharmacological Therapy

Nonpharmacological Therapy for STEMI

For patients with STEMI, primary PCI (with either balloon angioplasty or stent placement) is the treatment of choice for reestablishing coronary artery blood flow when the patient with STEMI presenting within 12 hours of the onset of chest discomfort. [more effective and safer (less risk of bleeding)].

Nonpharmacological Therapy for NSTEMI

In patients with NSTEMI, it is recommended either PCI or coronary artery bypass grafting (CABG) revascularization as an early treatment.

Pharmacological Therapy

All patients with suspected acute coronary syndrome should be admitted urgently to hospital because there is a significant risk of death or recurrent myocardial ischemia during the early unstable phase.

Early Pharmacotherapy for STEMI.

Treatment of STEMI may be divided into four categories:

• Provide immediate care to alleviate pain, prevent deterioration and improve cardiac function.

• Restore coronary flow and myocardial tissue perfusion.

• Manage complications, notably heart failure and arrhythmias.

• Prevent further infarction or death (secondary prophylaxis).

Early pharmacologic therapy for patients with STEMI should include:

1-Oxygen: (if oxygen saturation is <90%). It should only be administered in cases of hypoxemia or respiratory distress; a recent trial has demonstrated the potential of harm if used in normoxemia patients.

2-Morphine: Morphine is administered as an analgesic to relieve chest pain. Pain is associated with sympathetic activation, which causes vasoconstriction, increases the workload of the heart and can exacerbate the underlying condition.

3-Sublingual followed by intravenous (IV) nitroglycerin:

Immediately upon presentation, one sublingual nitroglycerin (NTG) tablet should be administered every 5 minutes for up to three doses.

Intravenous NTG should be initiated (unless C/I) in all patients with an ACS who have persistent ischemic symptoms (i.e. not controlled by SL nitroglycerin), heart failure, or uncontrolled high blood pressure. Treatment should be continued for about 24 hours after ischemia is relieved.

4-Fibrinolytic Therapy:

in the absence of contraindications, a fibrinolytic agent should be given to patients with STEMI presenting within 12 hours of the onset of chest discomfort when it is anticipated that primary PCI cannot be performed within 120 minutes of first medical contact. The greatest benefit is seen when this is performed within the first 4 hours of onset of pain.

In patients who present within 12 to 24 hours of symptom onset, fibrinolytic therapy is reasonable for patients with STEMI if there is clinical and/or ECG evidence of ongoing ischemia.

Fibrin-specific agent (alteplase, reteplase, tenecteplase) is preferred over the non-fibrin-specific agent streptokinase. Fibrin-specific agents open a greater percentage of infarct arteries.

The major hazard of thrombolytic therapy is bleeding. Cerebral hemorrhage causes 4 extra strokes per 1000 patients treated, and the incidence of other major bleeds is between 0.5% and 1%. Accordingly, the treatment should be withheld if there is a significant risk of serious bleeding. (table below)

Relative contraindications to thrombolytic

- Active internal bleeding
- Previous subarachnoid or intracerebral haemorrhage
- Uncontrolled hypertension
- Recent surgery (within 1 month)
- Recent trauma (including traumatic resuscitation)
- High probability of active peptic ulcer
- Pregnancy

5-Antiplatelet and anticoagulant Therapy

Aspirin:

An aspirin tablet (300–325 mg) chewed as soon as possible after the infarct (within the first 24 hours of hospital admission) and followed by a daily dose of 75 mg for

at least 1 month has been shown to reduce mortality and morbidity. Current recommendations state aspirin should be taken indefinitely.

P2Y12 receptor inhibitor (Clopidogrel, Prasugrel, Ticagrelor)

P2Y12 inhibitor therapy should be given for all patients with STEMI in addition to aspirin [Dual antiplatelet therapy (DAPT)]. Clopidogrel, given in addition to aspirin, can further improve coronary artery blood flow.

They are usually given as loading dose (300-600 mg for clopidogrel) followed by maintenance dose (75 mg for clopidogrel). DAPT should be continued after ACS for at least 12 months.

Anticoagulants

Anticoagulant medications such as unfractionated heparin (UFH), low-molecular-weight (LMW) heparin, or bivalirudin have been shown to decrease re-occlusion and reinfarction following reperfusion therapy. They are given routinely to patients with acute coronary syndrome unless contraindicated.

Glycoprotein IIb/IIIa Receptor Inhibitors

In patient undergoing PCI in STEMI and receive UFH as an anticoagulant, a GP IIb/IIIa inhibitor (usually abciximab or eptifibatide) should be added to UFH (in addition to a P2Y12 receptor inhibitor and aspirin). Glycoprotein IIb/IIIa receptor antagonists, particularly abciximab, have been shown to reduce mortality if used during the procedure. So, current recommendations are that in the setting of dual-antiplatelet therapy with unfractionated heparin as the anticoagulant, glycoprotein IIb/IIIa receptor antagonists can be useful at the time of primary PCI for bailout (intraprocedure thrombus formation, slow low, threatened vessel closure) but cannot be recommended as routine therapy.

6-β-Adrenergic Blockers

I.V bolus or oral doses of a β-blocker should be administered early for patients with STEMI (within the first 24 hours), and then an oral β-blocker should be continued indefinitely.

Note: In the setting of STEMI, calcium channel blockers are reserved for patients who have contraindications to β-blockers. Current data suggest little clinical benefit beyond symptom relief.

7-ACE inhibitors:

An ACE inhibitor (or ARBs in patients intolerant of ACE inhibitors) should be started within 24 hours of presentation, in the absence of contraindications.

Angiotensin-converting enzyme (ACE) inhibitors reduce cardiac workload and decrease post-MI cardiac remodeling.

Early Pharmacotherapy for NSTEMI

Early pharmacotherapy for UA/ NSTEMI is similar to that for STEMI except that fibrinolytic therapy is never administered to NSTEMI. The risk of death from MI is lower in these patients, and the hemorrhagic risks of fibrinolytic therapy outweigh the benefits.

Long-term therapy Following MI.

Those who have experienced MI have an increased risk of further attacks so secondary prevention is important.

The ACC/AHA guidelines suggest that after MI from either (STEMI or NSTEMI), patients should receive indefinite treatment with aspirin, a β-blocker, and an ACE inhibitor.

1-Aspirin:

All patients should receive aspirin indefinitely (or clopidogrel if aspirin is C/I).

2-ACE Inhibitors and Angiotensin Receptor Blockers:

ACE inhibitors should be initiated in all patients after MI to prevent the development of heart failure and reduce mortality. Long-term treatment with ACE inhibitors or ARBs can counteract ventricular remodeling, improve survival, reduce recurrent MI and avoid rehospitalization.

3-β-Blockers:

After an ACS, patients should receive a B-blocker indefinitely. Long-term use of a β-blocker is recommended to decrease mortality in patients in whom there is no contraindication A calcium channel blocker can be used in patients who cannot tolerate or have a contraindication to a β-blocker.

4- Nitrates:

All patients should be prescribed a short-acting sublingual NTG or lingual NTG spray to relieve anginal symptoms when necessary.

5- P2Y12 receptor inhibitor (Clopidogrel, Prasugrel, Ticagrelor).

P2Y12 receptor inhibitor should be prescribed to all patients with MI [STEMI or NSTEMI].

6-Aldosterone Antagonists (eplerenone or spironolactone):

Either eplerenone or spironolactone should be considered within the first 2 weeks after MI to reduce mortality and hospitalization and to improve survival in all patients with LVEF ≤40% and either diabetes mellitus or heart failure symptoms who are already receiving an ACE inhibitor. The drugs are continued indefinitely.

7-Lipid-Lowering Agents:

All patients, regardless of LDL-cholesterol level, should ideally be prescribed a high-intensity statin. Patients over 75 years of age may be prescribed a moderate-intensity statin.

There is increasing evidence that they also have short-term benefits in the treatment of acute MI. Recent data indicate that all patients with CAD benefit from statins, regardless of baseline LDL. Beyond their lipid-lowering properties, statins are believed to exhibit pleiotropic effects (Treatment with statins in the acute setting can promote plaque stabilization, reverse endothelial dysfunction, and decrease thrombogenicity). A lipid profile should be assessed within 24 hours of the acute MI and, unless contraindicated, statin therapy should be started as soon as possible