MYOCARDIAL INFARCTION: PATHOPHYSIOLOGY, DIAGNOSIS, AND MODERN MANAGEMENT

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Abstract

Myocardial infarction (MI) remains one of the leading causes of morbidity and mortality worldwide. It results from an acute interruption of coronary blood flow, leading to ischemia and irreversible necrosis of myocardial tissue. This article reviews the current understanding of the pathophysiology, risk factors, clinical presentation, diagnostic approaches, and evidence-based management strategies for myocardial infarction, with an emphasis on early reperfusion therapy and secondary prevention.

Keywords: Myocardial infarction, ischemic heart disease, reperfusion therapy, troponin, coronary artery disease.

1. Introduction

Myocardial infarction is a critical manifestation of ischemic heart disease and represents a major public health challenge. Despite advances in preventive cardiology and interventional techniques, MI continues to impose a significant clinical and economic burden. Understanding its underlying mechanisms and optimal management is essential for improving patient outcomes.

2. Etiology and Risk Factors

The most common cause of myocardial infarction is atherosclerotic plaque rupture followed by thrombus formation within a coronary artery. Risk factors are divided into modifiable and non-modifiable categories. Modifiable factors include smoking, hypertension, dyslipidemia, diabetes mellitus, obesity, and sedentary lifestyle, whereas non-modifiable factors include advanced age, male sex, and genetic predisposition.

3. Pathophysiology

Plaque rupture exposes thrombogenic material, triggering platelet aggregation and thrombus formation. This leads to partial or complete occlusion of coronary blood flow. Prolonged ischemia results in myocardial cell death through necrosis and apoptosis. The extent of myocardial damage depends on the duration of ischemia, collateral circulation, and the timeliness of reperfusion therapy.

4. Clinical Presentation

Patients with myocardial infarction typically present with prolonged chest pain described as pressure or tightness, often radiating to the left arm, neck, or jaw. Associated symptoms include dyspnea, diaphoresis, nausea, vomiting, and anxiety. Atypical presentations are more common in elderly patients, women, and individuals with diabetes mellitus.

5. Diagnosis

Diagnosis of myocardial infarction is based on clinical symptoms, electrocardiographic changes, and cardiac biomarkers. Elevated cardiac troponins (I or T) are the most sensitive and specific indicators of myocardial injury. Electrocardiography differentiates ST-elevation MI

(STEMI) from non-ST-elevation MI (NSTEMI). Imaging modalities such as echocardiography and coronary angiography provide additional diagnostic and prognostic information.

6. Management Strategies

Early restoration of coronary blood flow is the cornerstone of myocardial infarction management. Primary percutaneous coronary intervention (PCI) is the preferred reperfusion strategy, while thrombolytic therapy is used when PCI is unavailable. Pharmacological treatment includes antiplatelet agents, anticoagulants, beta-blockers, angiotensin-converting enzyme inhibitors, and statins. Comprehensive cardiac rehabilitation and lifestyle modification are essential components of long-term management.

7. Complications and Prognosis

Complications of myocardial infarction include arrhythmias, heart failure, cardiogenic shock, and mechanical complications such as ventricular septal rupture. Prognosis depends on infarct size, left ventricular function, and the promptness of reperfusion therapy. Advances in acute care have significantly improved survival rates.

8. Conclusion

Myocardial infarction remains a life-threatening condition requiring rapid diagnosis and aggressive management. Early reperfusion, evidence-based pharmacotherapy, and effective secondary prevention strategies are crucial for reducing mortality and improving quality of life among affected patients.

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