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PATHOLOGICAL ANATOMY OF MYOCARDIAL INFARCTION

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Abstract: Myocardial infarction (MI) represents one of the most common and life-threatening cardiovascular diseases worldwide. It is characterized by ischemic necrosis of the heart muscle due to prolonged obstruction of coronary blood flow. This paper provides a comprehensive overview of the pathological anatomy of myocardial infarction, including its etiology, morphological changes, histopathological features, and clinical implications. The study synthesizes findings from classical pathology, modern histology, and clinical research to highlight the importance of understanding myocardial infarction in both diagnostic and therapeutic contexts.

Keywords: Myocardial infarction; pathological anatomy; ischemia; necrosis; histopathology; cardiovascular disease

Introduction: Pathological anatomy is the branch of medical science that studies structural changes in organs and tissues caused by disease. Among cardiovascular disorders, myocardial infarction is one of the most significant causes of morbidity and mortality. Understanding the morphological and histological changes in myocardial tissue during infarction is crucial for accurate diagnosis, effective treatment, and prevention of complications.This paper aims to analyze the pathological anatomy of myocardial infarction, focusing on gross and microscopic changes, stages of necrosis, and subsequent tissue repair. The study also emphasizes the clinical relevance of these findings in modern cardiology.

Materials and Methods: This research is based on a literature review of textbooks in pathological anatomy, peer-reviewed articles, and clinical case studies published between 2000 and 2025. Sources were collected from PubMed, ScienceDirect, and pathology reference manuals. The methodology included:

Gross pathology analysis: Reviewing macroscopic features of infarcted myocardium.

Histopathology: Examining microscopic changes in cardiomyocytes and interstitial tissue.

Comparative studies: Evaluating differences between acute and chronic infarction.

Clinical correlation: Linking pathological findings with patient outcomes.

Results and Discussion:Etiology

Myocardial infarction is most commonly caused by atherosclerotic plaque rupture and subsequent thrombosis in coronary arteries. Other causes include vasospasm, embolism, and prolonged hypotension.

Gross Pathology

- **Early stage (0–12 hours):** No visible changes or slight pallor of myocardium.
- **Intermediate stage (12–24 hours):** Dark mottling appears; myocardium becomes firm.

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- **Late stage (1–7 days):** Yellow-tan necrotic tissue surrounded by hyperemic border.
- **Chronic stage (weeks to months):** Scar formation with fibrous tissue replacing necrotic myocardium.

Histopathology

- **0–6 hours:** Wavy fibers due to stretching of necrotic myocytes.
- **6–24 hours:** Coagulative necrosis, cytoplasmic eosinophilia, nuclear pyknosis.
- **1–3 days:** Neutrophilic infiltration, loss of nuclei, and striations.
- **3–7 days:** Macrophage infiltration, phagocytosis of necrotic tissue.
- **7–14 days:** Granulation tissue formation with fibroblasts and angiogenesis.
- **>1 month:** Dense collagenous scar formation.

Clinical Correlation: The pathological changes explain clinical features such as chest pain, arrhythmias, and risk of complications (ventricular rupture, aneurysm, heart failure). Histological staging is essential for forensic pathology to determine the timing of infarction.

Conclusion: Myocardial infarction is a critical pathological condition characterized by ischemic necrosis of cardiac muscle. Its pathological anatomy reveals a sequence of gross and microscopic changes that progress from acute necrosis to chronic scar formation. Understanding these changes is vital for diagnosis, treatment, and prevention of complications. Pathological anatomy thus provides the foundation for clinical cardiology and forensic medicine in evaluating myocardial infarction.

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