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Commentary

Clinical Implications of Cardiac Biomarkers in the Diagnosis of Acute Coronary Syndromes

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DESCRIPTION

Acute Coronary Syndromes (ACS) represent a spectrum of life-threatening conditions, ranging from unstable angina to Myocardial Infarction (MI). Timely and accurate diagnosis is important for appropriate management, as the clinical presentation of ACS can often be difficult, with symptoms underlying with other conditions like gastrointestinal disorders or pulmonary embolism. In recent years, cardiac biomarkers have emerged as invaluable tools for diagnosing ACS, guiding therapeutic interventions, and predicting patient outcomes.

Cardiac biomarkers

Cardiac biomarkers are substances released into the bloodstream during myocardial injury. These biomarkers reflect the extent of myocardial damage and can be used both to confirm the diagnosis of ACS and to evaluate the severity of the event. While biomarkers like Creatine Kinase-MB (CK-MB) and myoglobin have long been used, more specific and sensitive markers have emerged in recent years, most notably troponins (specifically high-sensitivity troponin T and troponin I) and B-type Natriuretic Peptide (BNP).

Role of cardiac biomarkers in the diagnosis of ACS

Early and accurate identification of ACS is most important for optimal treatment and preventing adverse outcomes like heart failure, cardiogenic shock, and death. The presentation of ACS, particularly unstable angina and Non-ST-Elevation Myocardial Infarction (NSTEMI), can be highly variable, making it difficult to distinguish from other conditions with similar symptoms.

Troponins

Cardiac troponins are widely regarded as the most sensitive and specific biomarkers for diagnosing myocardial injury. Troponins are proteins found in cardiac muscle fibers, and their release into the bloodstream occurs when myocardial cells are damaged. High-sensitivity assays (hs-cTn) have revolutionized the diagnostic landscape for ACS, offering increased precision in identifying even low levels of myocardial injury. A rise in troponin levels is seen in nearly all forms of ACS, including ST-Elevation Myocardial Infarction (STEMI), NSTEMI, and unstable angina. The diagnostic value of troponins lies in their ability to detect minor myocardial injury that would otherwise be undetectable with older biomarkers like CK-MB. The timing of troponin release also aids in distinguishing between acute and chronic ischemia, with levels rising within 3 to 12 hours of an infarction and remaining elevated for days to weeks, depending on the severity of injury.

Other biomarkers in diagnosis

While troponins are the primary biomarkers for diagnosing ACS, other biomarkers can aid in risk stratification and provide complementary diagnostic information. For example, Creatine Kinase-MB (CK-MB) is still used in some clinical settings but has lower specificity than troponins, as it can be elevated in skeletal muscle injury. Myoglobin, another early biomarker, rises quickly following myocardial injury but lacks the specificity of troponin. B-type Natriuretic Peptide (BNP) and N-terminal pro-BNP (NT-proBNP), primarily used to diagnose and assess heart failure, are also useful in the setting of ACS, especially in patients who present with heart failure symptoms. Elevated BNP levels may correlate with the severity of left ventricular dysfunction and fluid overload, which are common complications of STEMI and NSTEMI.

Prognostic value of cardiac biomarkers in ACS

Cardiac biomarkers do not only aid in diagnosis but also provide valuable insights into the prognosis of patients with ACS. The level of troponin elevation, the timing of its release, and its implications over time can all inform clinicians about the extent of myocardial injury, the risk of complications, and the likelihood of adverse cardiovascular events.

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Therapeutic implications of cardiac biomarkers

The measurement of cardiac biomarkers in ACS not only helps with diagnosis and risk assessment but also plays a pivotal role in guiding treatment decisions. Elevated biomarkers, particularly troponins, can prompt clinicians to initiate early invasive therapies, such as Percutaneous Coronary Intervention (PCI) or Coronary Artery Bypass Grafting (CABG), to restore blood flow to ischemic myocardium. In patients with high-risk profiles based on biomarker levels, dual antiplatelet therapy and anticoagulation strategies may be adjusted to prevent recurrent ischemic events.

CONCLUSION

Cardiac biomarkers have become indispensable in the diagnosis and management of ACS. From their role in early diagnosis to their contribution to prognostic assessment and treatment decision-making, biomarkers like troponins, BNP, and CRP provide essential insights that improve patient outcomes. The future of ACS management lies in integrating biomarkers with other diagnostic modalities and refining their use in personalized care, ensuring that clinicians can provide targeted therapies to the right patients at the right time.