ANALYTICAL AND CLINICAL SIGNIFICANCE OF TROPONIN TESTS IN THE DIAGNOSIS OF ACUTE MYOCARDIAL INFARCTION

Turakulov Zhavlon Sodik ugli

Assistant of the Department of Clinical Laboratory Diagnostics and with a course in clinical laboratory diagnostics PGF

E-mail: sammi@sammi.uz

Phone: +998937034142

Oblokulova Dilfuza Shukhrat kizi

Cadet of the Department of Clinical Laboratory Diagnostics and with a course in clinical laboratory diagnostics PGF

ANNOTATION. In modern cardiology practice, determining cardiac troponin levels serves as the "gold standard" for verifying acute myocardial infarction. This article presents a comprehensive analysis of the evolution of laboratory methods for detecting troponins I and T, highlighting the significant increase in the analytical sensitivity of modern test systems. The author examines the problem of interpreting subclinical biomarker concentrations, which arises with the introduction of highly sensitive methods (high-sensitivity troponin, hs-Tn).

Keywords: troponin, acute myocardial infarction, biomarker, laboratory testing.

Introduction. Troponin is firmly established as the gold-standard biomarker for diagnosing acute myocardial infarction. The past two decades have witnessed a paradigm shift in laboratory methodologies, characterized by significantly lowered detection limits and superior assay precision. Nevertheless, the clinical utility of these technical advancements is inherently tied to the practitioner's interpretive proficiency.

The strategic use of troponin testing hinges upon a triad of essential elements: the analytical robustness of the assay, the clinical diagnostic performance (sensitivity and specificity), and a well-defined clinical justification for the test based on the specific patient presentation [3,12].

The troponin complex consists of three subunits - T, I, C, which regulate the contractile activity of the myocardium. Cardiac troponin T, the tropomyosin-binding subunit, anchors the troponin complex to thin actin filaments. Troponin C, a calcium-binding subunit, binds calcium ions entering the cytoplasm from the sarcoplasmic reticulum upon contraction stimulation. Troponin I, an inhibitory subunit, blocks the hydrolysis of adenosine triphosphate, which is necessary for the interaction of actin and myosin. In the late 1980s, researchers developed immunoassays for troponin I and troponin T. Improvements in antibodies, reagents, and automation have made today's commercial troponin assays extremely sensitive and accurate. Newest, the most sensitive assays are able to detect troponin in the circulation of patients without myocardial injury, possibly due to normal turnover of myocardial cells or the formation of exosomes that release small amounts of free troponin into the circulation [6,8,10]. All three components are essential to ensure the effective clinical application of troponin testing. In practice, most clinicians rely on their laboratory teams to determine the analytical performance of assays and often lack detailed knowledge of the underlying laboratory science of troponin measurement. Clinical sensitivity and specificity of troponin tests can be confusing, as definitions have evolved over time and multiple assay types are now available. Moreover, clinicians frequently pay limited attention to integrating troponin results with other relevant clinical information. While review articles provide guidance on assay performance and appropriate use, additional clarification can further support clinical decision-making [2,5,7].

Manufacturers of troponin assays are responsible for evaluating and disclosing the analytical performance metrics of their products. Analytical sensitivity denotes the minimum concentration of the analyte that can be detected with statistical reliability. Assay precision is quantified by the coefficient of variation (CV), representing the

variability of results relative to the analyte's concentration; typically, an inverse relationship exists where lower concentrations yield higher CV values. Ideally, the CV at the clinical cut-off should remain below 10%. While automated central laboratory assays maintain superior precision with CV levels under 10%, point-of-care (POC) platforms often exhibit CVs near the 10% threshold roughly an order of magnitude less precise than centralized systems. Consequently, POC assays are suboptimal for serial troponin monitoring, as inherent measurement inaccuracies may produce misleading trends in troponin fluctuations [3,8, 11]

Due to the exclusive patent, there is only 1 commercially available troponin T test. The fourth generation of this assay is currently in use in the United States, and the new generation troponin T test, which is more analytically sensitive, is now in use in Europe. There are many commercially available troponin I tests. These tests have also undergone several generations of improvements over the years. Each of the various commercial troponin I assays recognizes a unique amino acid sequence (epitope) of the troponin I molecule, resulting in each assay having different analytical characteristics. These differences have created problems for researchers and regulators who are trying to develop industry standardization for troponin tests. The differences also pose challenges for physicians who are trying to understand published medical reports of troponin testing and apply the research findings to practice [1,4,9].

Conclusion. The clinical evaluation of troponins is a fundamental pillar in the diagnostic framework of acute myocardial infarction, attributed to their exceptional sensitivity and specificity. While recent technological strides have refined the analytical precision of these assays allowing for the detection of minute protein concentrations their clinical utility depends heavily on nuanced interpretation. Effective decision-making must bridge the gap between laboratory accuracy and the patient's clinical presentation, acknowledging inherent assay variability. Furthermore, the limited precision of point-of-care testing modalities renders them suboptimal for serial monitoring compared to centralized laboratory methods. Ultimately, improving

patient outcomes in cardiovascular medicine necessitates a holistic approach that synergizes advanced assay characteristics with comprehensive clinical data.

LITERATURE:

1. Berdiyarova Sh.Sh., Ahadova M.M., Ochilov S.A., «COMPLICATIONS OF TREATMENT OF ACUTE HEMATOGENOUS OSTEOMYELITIS, LITERATURE REVIEW» Galaxy International Interdisciplinary Research Journal 293-298 стр.

2. Chaulin A.M., Duplyakov D.V. MicroRNAs in Atrial Fibrillation: Pathophysiological Aspects and Potential Biomarkers // Internat

3. Grigoryeva J, Suvorova G, Chaulin A, Chem-idronov S, Vankov V, Kulakova O, Bovtunova S. Con-cerning some morphofunctional aspects of the uterine cervical ripenening. Archiv Euromedica. 2020. Vol. 10, no. 4. P. 41-47.

4. Shukurullaevna B. S. et al. THE IMPORTANCE OF THROMBODYNAMICS IN POSTOPERATIVE PATIENTS //Web of Medicine: Journal of Medicine, Practice and Nursing. – 2025. – Т. 3. – №. 5. – С. 676-680.

5. Pronina A, Suvorova G, Chaulin A, Grigo-ryeva J, Rusakov D, Pronina N, Zinkina A, Trusov Y. Basic principles and methods of modeling hypogonad-ism: a literature review. Archiv Euromedica. 2020. Vol. 10, no. 4. P. 56-62.

6. Kamolidinovna I. L. et al. DIAGNOSIS OF TRACE ELEMENT IMBALANCE: IMPACT ON HEALTH AND DETECTION METHODS //Web of Medicine: Journal of Medicine, Practice and Nursing. – 2025. – Т. 3. – №. 1. – С. 270-272.

7. N Yusupova, O Firdavs, E Surayyo. NFLUENCE OF ENERGY DRINKS ON INDIVIDUAL SYSTEMS OF THE HUMAN BODY. International Journal of Early Childhood Special …, 2022.

8. YN Abdikodirovna, OF Suratovich, B Ogiloy, N Surayyo. Influence of energy drinks components on different human organs and systems- Int Sci Res J, 2023.

9. Бердиярова Ш. Ш., Нажмиддинова Н. К., Адашева Ш. Ш. Лабораторные показатели для ранней диагностики инфаркта миокарда //global research and academic innovations. – 2026. – Т. 2. – №. 1. – С. 134-141.

10. Бердиярова Ш. Ш. и др. СОВРЕМЕННАЯ ЛАБОРАТОРНАЯ ДИАГНОСТИКА АДНЕКСИТА //ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ. – 2025. – Т. 83. – №. 5. – С. 94-101.

11. Камолидиновна И.Л. и др. ДИАГНОСТИКА КОАГУЛОПАТИЙ У БЕРЕМЕННЫХ ЖЕНЩИН: ПРИМЕНЕНИЕ ТРОМБОЭЛАСТОГРАФИИ //Web of Medicine: Journal of Medicine, Practice and Nursing. – 2025. – Т. 3. – № 1. – С. 241-243.

12. Рамолиддиновна И.Л., Туник У. СОВРЕМЕННАЯ ЛАБОРАТОРНАЯ ДИАГНОСТИКА БЕРЕМЕННЫХ ЖЕНЩИН С АТЕРОСКЛЕРОЗОМ //Web of Discoveries: Journal of Analysis and Inventions. – 2024. – Т. 2. – № 5. – С. 98-100.