

COMPARAÇÃO DE ALGORITMOS DE TROPONINA T CARDÍACA DE ALTA SENSIBILIDADE DE UMA E DUAS HORAS PARA O DIAGNÓSTICO DE ENFARTE AGUDO DO MIOCÁRDIO

COMPARISON OF ONE-HOUR AND TWO-HOUR HIGH-SENSITIVITY CARDIAC TROPONIN T ALGORITHMS FOR THE DIAGNOSIS OF ACUTE MYOCARDIAL INFARCTION

João Pedro Cardoso Faccio¹, Ana Maria Lorenzatto².

1. Professor do curso de Medicina da Afya Centro Universitário de Pato Branco - PR; **2.** Acadêmica do curso de Medicina da Afya Centro Universitário de Pato Branco - PR.

E-mail do autor correspondente: ana.lorenzatto@alunos.afya.com.br

Eixo Temático: Saúde.

RESUMO

O infarto agudo do miocárdio constitui uma emergência cardiovascular na qual o diagnóstico precoce é fundamental para a instituição adequada do tratamento. A utilização da troponina cardíaca de alta sensibilidade possibilitou o desenvolvimento de estratégias diagnósticas aceleradas para pacientes com suspeita de infarto, reduzindo o tempo necessário para sua confirmação ou exclusão. O objetivo deste estudo foi comparar o desempenho diagnóstico de dois algoritmos baseados na troponina cardíaca T de alta sensibilidade, utilizando intervalos de uma e duas horas para avaliação de pacientes com suspeita de infarto agudo do miocárdio. Foi realizada uma revisão comparativa de dois estudos clínicos publicados por Reichlin et al., sendo analisados o tamanho das amostras, o intervalo entre as dosagens do biomarcador, a classificação dos pacientes e os parâmetros de desempenho diagnóstico. O algoritmo de uma hora permitiu classificar 77% dos pacientes como casos para exclusão ou confirmação do infarto, apresentando sensibilidade e valor preditivo negativo de 100% para a exclusão da doença. O algoritmo de duas horas apresentou valor preditivo negativo de 99,9% na população de derivação e 99,5% na população de validação externa, demonstrando elevada segurança diagnóstica. Conclui-se que ambas as estratégias apresentam alto desempenho para a avaliação rápida de pacientes com suspeita de infarto agudo do miocárdio, sendo o algoritmo de uma hora mais rápido e o de duas horas capaz de proporcionar maior intervalo para avaliação da variação do biomarcador. A escolha da estratégia deve considerar o contexto clínico e ser integrada à avaliação clínica e eletrocardiográfica.

Palavras-chave: Infarto do Miocárdio. Troponina. Biomarcadores. Diagnóstico. Dor no Peito.

ABSTRACT

Acute myocardial infarction is a cardiovascular emergency where early diagnosis is crucial for appropriate treatment. The use of high-sensitivity cardiac troponin has allowed the development of accelerated diagnostic strategies for patients with suspected infarction, reducing the time required for confirmation or exclusion. The aim of this study was to compare the diagnostic performance of two algorithms based on high-sensitivity cardiac troponin T, using one- and two-hour intervals for the evaluation of patients with suspected acute myocardial infarction. A comparative review of two clinical studies published by Reichlin et al. was conducted, analyzing sample size, interval between biomarker measurements, patient classification, and diagnostic performance parameters. The one-hour algorithm allowed the classification of 77% of patients as cases for exclusion or confirmation of infarction, providing sensitivity and negative predictive value of 100% for excluding the disease. The two-hour algorithm showed a negative predictive value of 99.9% in the derivation population and 99.5% in the external validation population, demonstrating high diagnostic reliability. It is concluded that both strategies perform well for the rapid assessment of patients with suspected acute myocardial infarction, with the one-hour algorithm being faster and the two-hour algorithm providing a longer interval for evaluating biomarker variation. The choice of strategy should consider the clinical context and be integrated with clinical and electrocardiographic evaluation.

Keywords: Myocardial Infarction. Troponin. Biomarkers. Diagnosis. Chest Pain.

INTRODUCTION

Acute myocardial infarction (AMI) is one of the most important cardiovascular emergencies and requires rapid diagnosis to allow timely initiation of appropriate treatment. Patients presenting to emergency departments with acute chest pain may have a wide range of clinical manifestations, and the symptoms alone are not always sufficient to distinguish myocardial infarction from other causes of chest pain. In this context, cardiac biomarkers, particularly high-sensitivity cardiac troponin T (hs-cTnT), have become fundamental tools in the diagnostic evaluation of patients with suspected acute coronary syndrome. The increased analytical sensitivity of these assays allows the detection of lower concentrations of circulating troponin and facilitates the identification of myocardial injury at an earlier stage.¹

Despite the diagnostic value of cardiac troponin, a single measurement may not be sufficient to establish or exclude acute myocardial infarction, especially in patients who present shortly after the onset of symptoms. Serial measurements and assessment of changes in biomarker concentration over time have therefore become important components of accelerated diagnostic strategies. Reichlin et al.¹ demonstrated that an algorithm based on hs-cTnT concentrations at presentation and after one hour could

classify a substantial proportion of patients with suspected AMI rapidly and with high diagnostic accuracy. Subsequently, a two-hour algorithm was evaluated in a larger population and included an external validation cohort, providing additional evidence regarding the applicability of this approach.²

The development of accelerated algorithms has scientific and social relevance because chest pain is one of the most frequent reasons for emergency department visits, and prolonged diagnostic observation may contribute to overcrowding, increased healthcare costs, and unnecessary hospitalization. On the other hand, an overly rapid discharge of patients with an undiagnosed AMI may result in serious clinical consequences. Therefore, strategies capable of safely identifying patients at low probability of AMI while rapidly recognizing those who require treatment have considerable importance for both healthcare systems and patient outcomes.^{1,2}

Although both studies demonstrated high diagnostic performance using hs-cTnT, an important gap remains regarding the interpretation of the differences between shorter and longer serial measurement intervals. The one-hour strategy prioritizes diagnostic speed, whereas the two-hour strategy provides additional time for evaluation of biomarker kinetics and was subsequently assessed in an external validation population.^{1,2} Understanding these differences is relevant for determining how accelerated troponin-based strategies can be incorporated into the diagnostic evaluation of patients with suspected AMI, particularly because biomarker results should be interpreted in conjunction with the clinical presentation and electrocardiographic findings.

Therefore, the objective of this study was to compare the one-hour and two-hour high-sensitivity cardiac troponin T algorithms for the diagnosis of acute myocardial infarction, analyzing their methodological characteristics, diagnostic performance, advantages, limitations, and potential clinical applicability in patients presenting with suspected acute myocardial infarction.

METHODS

This study consisted of a comparative narrative literature review based on two original scientific articles addressing the use of high-sensitivity cardiac troponin T (hs-cTnT) algorithms for the rapid diagnosis of acute myocardial infarction. The review was guided by the following question: what are the similarities and differences in the

diagnostic performance and clinical applicability of one-hour and two-hour hs-cTnT algorithms in patients with suspected acute myocardial infarction?

The PubMed database was used to identify the studies included in this review. The search was directed toward studies addressing accelerated diagnostic algorithms based on high-sensitivity cardiac troponin T and their application in patients with suspected acute myocardial infarction. The two studies selected for analysis were published in 2012 and 2015, respectively, and were identified through their PubMed records.

The search strategy included combinations of the terms “acute myocardial infarction”, “high-sensitivity cardiac troponin T”, “one-hour algorithm”, and “two-hour algorithm”, using the Boolean operator AND when necessary. The search was focused on studies directly related to the diagnostic use of high-sensitivity cardiac troponin T in patients with suspected acute myocardial infarction.

The inclusion criteria were original studies published in English, available through PubMed, involving patients with suspected acute myocardial infarction and evaluating diagnostic algorithms based on high-sensitivity cardiac troponin T with serial measurements. Studies were excluded when they did not directly evaluate the diagnostic application of high-sensitivity cardiac troponin T, did not address acute myocardial infarction, or did not provide relevant information for comparison of accelerated diagnostic strategies.

Study selection was performed based on the relevance of the articles to the research question and their direct applicability to the proposed comparison. Two studies were ultimately included: the investigation by Reichlin et al. evaluating a one-hour algorithm¹ and the subsequent study by Reichlin et al. evaluating a two-hour algorithm.² The studies were compared according to study population, sample size, timing of troponin measurements, classification into rule-out, rule-in, and observational categories, sensitivity, specificity, positive predictive value, negative predictive value, and potential clinical applicability.

As this was a narrative literature review based on previously published studies, no new data were collected from human participants. The review did not follow a systematic review protocol such as PRISMA, JBI, or a scoping review framework.

RESULTS

The two selected studies evaluated accelerated diagnostic algorithms using high-sensitivity cardiac troponin T (hs-cTnT) in patients with suspected acute myocardial infarction. The first study assessed a one-hour algorithm in 872 patients, while the second evaluated a two-hour algorithm in 1,148 patients in the derivation cohort and 517 in an external validation cohort. The main findings are summarized in Table 1.

Table 1. Comparison of the one-hour and two-hour hs-cTnT algorithms

Variable	One-hour algorithm ¹	Two-hour algorithm ²
Patients	872	1,148 + 517
Rule-out	60%	60% / 78%*
Rule-in	17%	16% / 8%*
Observational	23%	24% / 14%*
Sensitivity for rule-out	100%	99.5% / 96%*
Negative predictive value	100%	99.9% / 99.5%*

*Derivation cohort / external validation cohort.

Source: Adapted from Reichlin et al.^{1,2}

The one-hour algorithm classified 77% of patients as rule-out or rule-in within one hour and demonstrated 100% sensitivity and negative predictive value for AMI exclusion.¹ The two-hour algorithm showed similarly high performance, with a negative predictive value of 99.9% in the derivation cohort and 99.5% in the external validation cohort.²

The main difference between the strategies was the interval between hs-cTnT measurements. The one-hour protocol provided faster classification, whereas the two-hour protocol allowed additional time to assess biomarker kinetics and demonstrated high performance in an external validation population.^{1,2} Overall, both strategies showed high diagnostic safety, particularly for ruling out acute myocardial infarction.

CONCLUSION

The evidence analyzed demonstrates that both one-hour and two-hour high-sensitivity cardiac troponin T algorithms provide high diagnostic accuracy for patients with suspected acute myocardial infarction, particularly for ruling out the disease. The one-hour strategy stands out for its greater speed, while the two-hour strategy provides

additional time to assess biomarker kinetics and has demonstrated consistent performance in an external validation cohort.^{1,2} The comparison contributes to the scientific understanding of accelerated diagnostic pathways by demonstrating that serial high-sensitivity troponin measurements can safely support rapid clinical decision-making when integrated with clinical assessment and electrocardiography.

In clinical practice, these strategies may reduce unnecessary observation and facilitate earlier treatment or discharge decisions, potentially improving emergency department efficiency. Future research should evaluate the performance of these algorithms in different populations and healthcare settings, including patients with atypical presentations and conditions that may influence troponin concentrations, as well as compare their cost-effectiveness and impact on clinical outcomes.

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