Improving the performance of high-sensitivity cardiac troponin for the diagnosis of myocardial infarction

Authors:
University of Edinburgh, Centre for Cardiovascular Science - Edinburgh - United Kingdom of Great Britain & Northern Ireland,

On behalf: High-STEACS Investigators

Topic(s):
Acute Coronary Syndromes: Biomarkers

Citation:

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Background: The Universal Definition of Myocardial Infarction (UDMI) mandates a rise and/or fall in high-sensitivity cardiac troponin (hs-cTn) concentration with at least one measure above the 99th centile of a healthy reference population. However, the 99th centile varies by age, sex, and prevalence of comorbid disease within reference populations, and the application of a single threshold may create diagnostic uncertainty in unselected patients attending the Emergency Department.

Purpose: To compare performance of hs-cTnI at the 99th centile with a model that includes additional clinical variables, for the diagnosis of type 1 myocardial infarction.

Methods: The High-Sensitivity Troponin in the Evaluation of patients with Acute Coronary Syndrome (High-STEACS trial) was a stepped wedge cluster randomised controlled trial of 48,282 consecutive patients across 10 hospitals in Scotland. We evaluated the positive predictive value (PPV) of a hs-cTnI >99th centile for a diagnosis of type 1 myocardial infarction. Patients with ST-segment elevation myocardial infarction (STEMI) were excluded, and all were adjudicated according to the 4th UDMI. The study population was randomly divided into derivation (80%) and internal validation (20%) cohorts. Using generalised additive modelling, we tested the effect of adding clinically relevant variables to hs-cTnI for the prediction of type 1 myocardial infarction in the derivation cohort, and assessed performance of the final model in the validation cohort.

Results: We included 47,101 consecutive patients (61±17 years, 47% female), of whom 9,057 (19%) had at least one hs-cTnI >99th centile (7,207 in derivation and 1,850 in validation cohorts). There were 4,087 (45%) patients with type 1 myocardial infarction, with 3239 (45%) and 848 (46%) in the derivation and validation cohorts, respectively. Across the study population, PPV for type 1 myocardial infarction reduced markedly with increasing age (Figure). Age, sex, chest pain, ischaemia on the electrocardiogram, creatinine and rate of change of hs-cTnI were included in the model. Comorbidities (ischaemic heart disease, diabetes, stroke and hyperlipidaemia) did not improve model performance. In the validation cohort, the area under the curve (AUC) for type 1 myocardial infarction using the 99th centile alone was 0.72 (95% CI 0.70-0.74), whereas the AUC for the optimised model was 0.84 (95% CI 0.82-0.85) (p<0.001 by DeLong’s test for difference, see Figure).

Conclusion: The diagnostic performance of the 99th centile for type 1 myocardial infarction is poor, particularly in older populations. A simple model including readily available clinical features improves diagnostic performance and with further external validation could support more individualised treatment decisions.
Abstract: Improving the performance of high-sensitivity cardiac troponin for the diagnosis of myocardial infarction

Authors: A Anand, ASV Shah, FE Strachan, KK Lee, AR Chapman, A Bularga, S Stewart, A Ferry, L Marshall, DE Newby, NL Mills

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