High-sensitivity cardiac troponin on presentation to rule out acute myocardial infarction

Anoop SV Shah MD,[1] Atul Anand MD,[1] Kuan Ken Lee MD,[1] Phil Adamson MD, [1]
Andrew Chapman MD, [1] Timothy Langdon MD, [1] Fiona Strachan PhD,[1]
David E Newby MD[1], David A McAllister MD[2] and Nicholas L Mills MD[1]
on behalf of the High STEACS Investigators

[1]*BHF Centre for Cardiovascular Science, University of Edinburgh, United Kingdom*
[2]*Centre for Population Health Sciences, University of Edinburgh, United Kingdom*
[3]*Department of Biochemistry, Southern General Hospital, United Kingdom*
[4]*Department of Biochemistry, Royal Infirmary of Edinburgh, United Kingdom*
[5]*Department of Cardiology, St George's Hospital and Medical School, United Kingdom*
[6]*Department of Laboratory Medicine and Pathology, University of Minnesota, United States of America*
[7]*Department of Emergency Medicine, Royal Infirmary of Edinburgh, United Kingdom*

Correspondence and requests for reprints:
Dr Anoop Shah,
BHF/University Centre for Cardiovascular Science,
SU.305 Chancellor's Building,
University of Edinburgh,
Edinburgh EH16 4SB
United Kingdom

Tel: +44 131 242 6432
Fax: +44 131 242 6379
E-mail: anoopsshah@gmail.com

Purpose: The majority of patients with chest pain do not have myocardial infarction and may be suitable for discharge directly from the Emergency Department. Whilst international guidelines recommend that troponin concentrations above the 99th centile be used to diagnose myocardial infarction, the optimal threshold to rule out myocardial infarction is uncertain. In a prospective trial we aim to define the optimal threshold to rule out myocardial infarction on presentation in consecutive patients with suspected acute coronary syndrome.

Methods: Serum troponin concentrations were measured using a high-sensitivity troponin I assay in consecutive patients with suspected acute coronary syndrome, in this prospective multi-centred cohort. The primary outcome was an index diagnosis of myocardial infarction, and myocardial infarction or cardiac death at 30 days. Myocardial infarction was adjudicated based on the results from high-sensitivity troponin assay. We evaluated the negative predictive value (NPV) of a range of troponin concentrations to determine the optimal threshold to rule out myocardial infarction on presentation.

Results: We identified 4,870 consecutive patients (age 64±16 years, 57% men) who presented with with suspected acute coronary syndrome. Myocardial infarction was diagnosed in 782 patients (16.1%) with 32 (0.7%) and 75 patients (1.5%) having myocardial infarction or cardiac death at 30 days respectively. A troponin concentration <5 ng/L on presentation had a NPV of 99.6% (95% confidence interval [CI] 99.4- 99.9%) for the primary endpoint (***Fig 1***), and identified 2,314 patients (48%) with a 3-fold lower risk of adverse cardiac events at one year than those where serial measurements <99th percentile were used to rule out myocardial infarction (1%

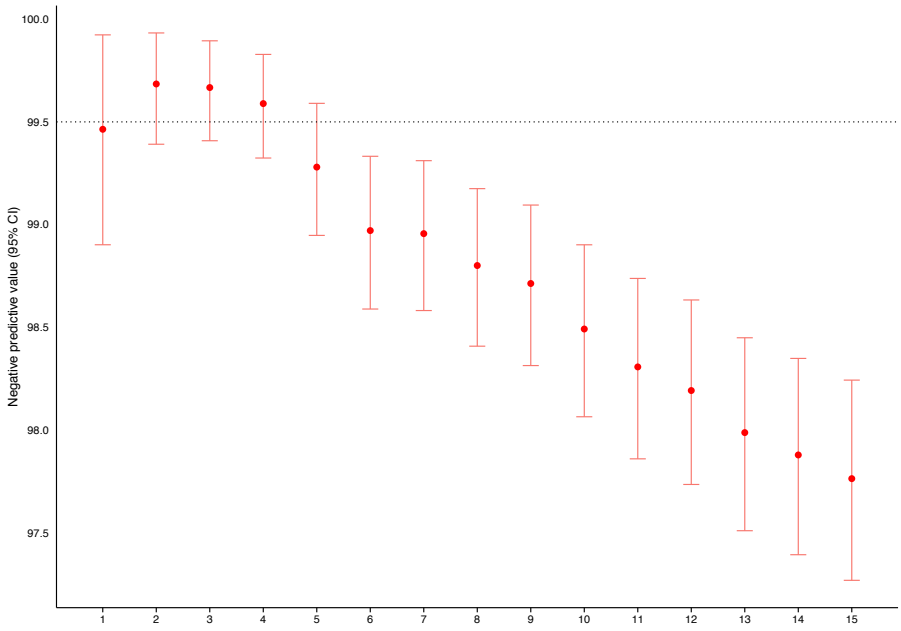
versus 3%; adjusted hazard ratio [95%CI] = 0.36 [0.19–0.69]) (***Fig 2***). The NPV of a troponin concentration <5 ng/L on presentation was similar in men and women and when stratified by age (above and below 65 years old), history of coronary heart disease or absence of myocardial ischemia on the initial electrocardiogram (***Fig 3***).

Conclusions: Troponin concentrations <5 ng/L on presentation correctly identified 2,305 out of 2,314 consecutive patients with suspected acute coronary syndrome who did not have myocardial infarction on serial testing or adverse cardiac events over the next 30 days. The NPV was 99.6% across the entire study population. Implementation of this approach would reduce hospital admissions and have major benefits for patients and healthcare providers.

Figure 1. Defining the optimal threshold to rule out myocardial infarction on presentation

a) Negative predictive value (NPV) of a range of troponin I concentrations on presentation for the composite outcome of index myocardial infarction, and myocardial infarction or cardiac death at 30 days; b) Proportion of patients with suspected acute coronary syndrome with troponin concentrations below each threshold.

a)



b)

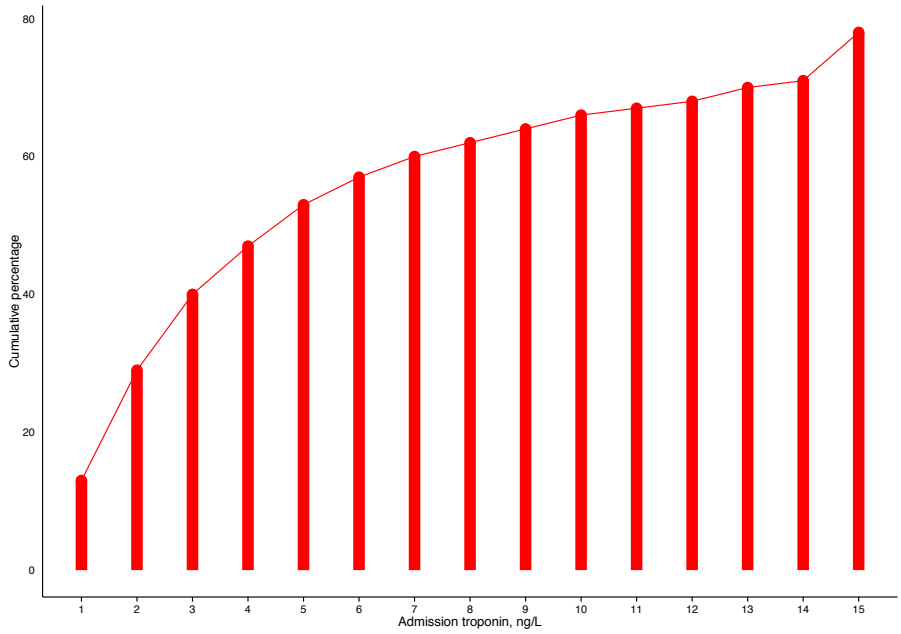


Figure 2. Negative predictive value of troponin concentrations <5 ng/L on presentation stratified into subgroups. Negative predictive value (NPV) of troponin I concentrations <5 ng/L on presentation for the composite outcome of index myocardial infarction, and myocardial infarction or cardiac death at 30 days.

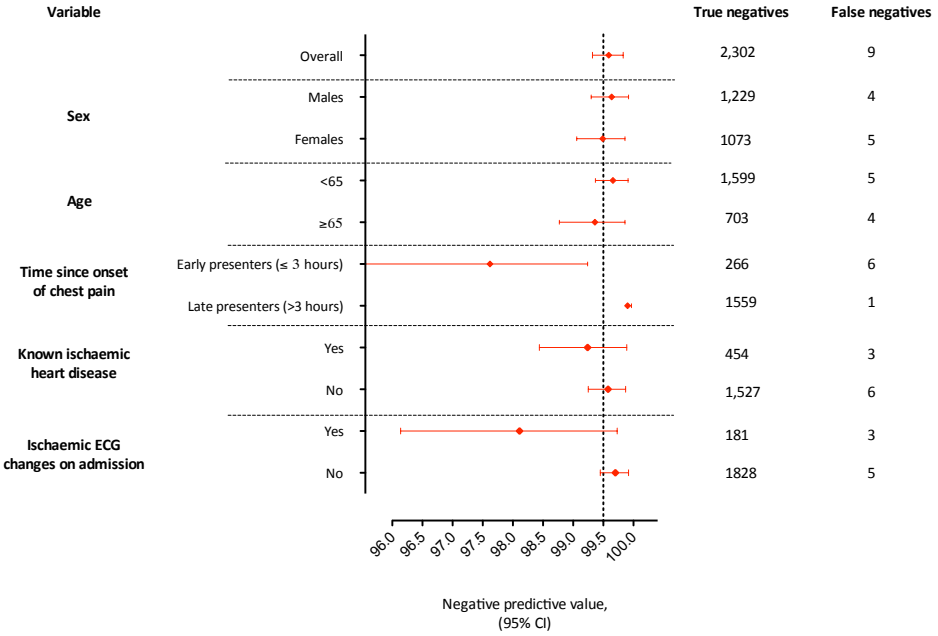


Figure 3 Cumulative incidence of myocardial infarction or cardiac death in patients with troponin concentrations less than the 99th centile on serial measurements

Patients without index myocardial infarction were stratified into two groups based on the troponin concentration on presentation. Compared to those patients with troponin concentrations <5 ng/L (blue line) those patients with troponin concentrations >5 ng/L (red line) were 3-fold less likely to have a myocardial infarction or cardiac death at one year (1% *versus* 3%; HR [95%CI] = 0.36 [0.19 to 0.69], log rank P<0.001).