Improved triage of nSTEMI patients with inconclusive HEARTscore at the Emergency Department

M.C.H. de Groot, E. Blasse, W.W. van Solinge, I. Hoefer, S. Haitjema
Laboratory of Clinical Chemistry and Haematology, University Medical Center Utrecht, Utrecht University, Utrecht, The Netherlands

Clinical problem

- Clinical triage of suspected nSTEMI in the Emergency Department (ED) remains challenging
- 80-90% of patients do not have acute coronary syndrome (ACS)
- Clinical risk scores are often inconclusive

Research question

Can machine learning-based modelling improve early triage in patients suspected for nSTEMI-ACS in the ED?

HEARTscore 4-7 (reference) Accuracy: 44% 'Missed' nSTEMIs: 1
Unnecessary stays: 228

Methods

- Machine learning models
 - Random forest, Logistic regression, Gradient boosting, Naive Bayes
- Models included individual (raw) HEARTscore parameters and/or combined with Celldyn
- Tweaking of cut-off value

Fig 1. Patient and data selection

Fig 2a. Model with best accuracy: Random forest

Based on HEARTscore parameters
Cut-off value: 0.85 Accuracy: 75%
'Missed' nSTEMIs: 10
Unnecessary stays: 89

Fig 2b. Model with highest negative predictive value: Naïve Bayes

Based on HEARTscore parameters
Cut-off value: 0.97 Accuracy: 55%
'Missed' nSTEMIs: 2
Unnecessary stays: 180

Fig 2c. Model based on blood cell characteristics only: Gradient boosting

Based on Celldyn only
Cut-off value: 0.85 Accuracy: 71%
'Missed' nSTEMIs: 9
Unnecessary stays: 109

Table 1. Baseline characteristics

N, %	nSTEMI N = 293	Control N = 731
Mean age (SD)	66 (13)	62 (13)
Male sex	211 (72%)	441 (60%)
Mean BMI (SD)	27.5 (5.6)	27.6 (5.9)
History of CVD	196 (67%)	429 (59%)
Diabetes	80 (27%)	186 (25%)
Positive family history	101 (36%)	235 (36%)
Dyslipidemia	120 (42%)	295 (42%)
Hypertension	190 (65%)	416 (58%)
Smoking	107 (37%)	223 (31%)

Conclusion

Early ACS triage for patients with suspected nSTEMI upon presentation at the Emergency Department can be facilitated by machine learning based-algorithms through inclusion of blood cell characteristics and individual components of the HEARTScore.