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Development of a novel risk stratification model to improve mortality prediction in acute coronary syndromes: The AMIS model

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Background: Current established models predicting mortality in acute coronary syndrome (ACS) patients are derived from randomised controlled trials performed in the 1990’s, and are thus based on and predictive for selected populations. These scores perform inadequately in patients treated according to current guidelines. The aim of this study was to develop a model with improved predictive performance applicable to all kinds of ACS, based on outcomes in real world patients from the new millennium.

Methods: The AMIS-Plus registry prospectively collects data from ACS patients admitted to 56 Swiss hospitals. Patients included in this registry between October 2001 and May 2005 (n = 7520) were the basis for model development. Modern data mining computational methods using new classification learning algorithms were tested to optimise mortality risk prediction using well-defined and non-ambiguous variables available at first patient contact. Predictive performance was quantified as “area under the curve” (AUC, range 0 – 1) in a receiver operator characteristic, and was compared to the benchmark risk score from the TIMI study group. Results were verified using 10-fold cross-validation.

Results: Overall, hospital mortality was 7.5%. The final prediction model was based on the “Averaged One-Dependence Estimators” algorithm and included the following 7 input variables: 1) Age, 2) Killip class, 3) systolic blood pressure, 4) heart rate, 5) pre-hospital mechanical resuscitation, 6) history of heart failure, 7) history of cerebrovascular disease. The output of the model was an estimate of in-hospital mortality risk for each patient. The AUC for the entire cohort was 0.875, compared to 0.803 for the TIMI risk score. The AMIS model performed equally well for patients with or without ST-Elevation (AUC 0.879 and 0.868, respectively). Subgroup analysis according to the initial revascularisation modality indicated that the AMIS model performed best in patients undergoing PCI (AUC 0.884 vs. 0.783 for TIMI) and worst for patients receiving no revascularisation therapy (AUC 0.788 vs. 0.673 for TIMI). The model delivered an accurate and reproducible prediction over the complete range of risks and for all kinds of ACS.

Conclusions: The AMIS model performs about 10% better than established risk prediction models for hospital mortality in patients with all kinds of ACS in the modern era. Modern data mining algorithms proved useful to optimise the model development.

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