Machine learning for in-hospital cardiac events prediction in patients with acute coronary syndrome: results from ADDICT-ICCU study

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Background: Acute coronary syndrome (ACS) remains a major cause of mortality worldwide. However, the accuracy of current prediction tools for in-hospital cardiac events after an ACS remains insufficient for individualized patient management strategies.

Purpose: To assess in patients with ACS the feasibility and accuracy of machine learning (ML)-based model using all data available at admission to predict in-hospital cardiac events.

Methods: We conducted a sub-study of ADDICT-ICCU registry, an observational prospective study including all consecutive patients admitted to intensive cardiac care unit (ICCU) in 39 centres throughout France between 7 and 22 April 2021. We evaluated 16 clinical, 4 biological and 6 transthoracic echocardiogram (TTE) features. ML involved automated feature selection with model building by random forest (RF), and then hyperparameter tuning was done by repeated cross-validation. The primary outcome was the occurrence of composite outcomes defined by death, resuscitated cardiac arrest or cardiogenic shock requiring medical and/or mechanical haemodynamic support.

Results: Of 1,499 consecutive patients, 765 (mean age 63±15 years, 70% male) were admitted for ACS. The overall in-hospital cardiac events rate for ACS patients was 4.0 %. Feature selection was performed using RF with the log-rank–based variable importance, and 6 of the available features at admission were selected for the RF model (1 clinical, 1 biological, and 4 from TTE) including mean blood pressure, renal function, cardiac output, filling pressures, tricuspid annular plane systolic excursion and pulmonary arterial systolic pressure. The ML model exhibited a higher area under the curve compared with TIMI score, GRACE score, and traditional stepwise model score for prediction of in-hospital cardiac events (ML score: 0.96 vs TIMI: 0.54, GRACE: 0.68, traditional stepwise score: 0.87; all P < 0.001).

Conclusions: The ML-model exhibited a higher prognostic value to predict in-hospital cardiac events compared with all traditional scores.
ML model for MACEs prediction
ML model performance (AUC)