Machine learning in the diagnosis of Myocardial Infarction with Non-Obstructive Coronary Arteries

M.J. Espinosa Pascual[1], P. Vaquero Martinez[2], V. Vaquero Martinez[3], J. Lopez Pais[4], B. Izquierdo Coronel[1], D. Galan Gil[1], R. Olsen Rodriguez[1], R. Abad Romero[1], D. Nieto Ibanez[1], C. Perela Alvarez[1], A. Fraile Sanz[1], R. Mata Caballero[1], C. Moreno Vinues[1], P. Awamleh Garcia[1], J.J. Alonso Martin[1]

[1]University Hospital of Getafe, Cardiology, Getafe, Spain; [2]University Hospital of Getafe, Getafe, Spain; [3]University of Valladolid, Valladolid, Spain; [4]CARDIOLOGY PRACTICE, Complejo Hospitalario Orense, Ourense, Spain

On behalf of IMACORN

Funding Acknowledgement: Type of funding sources: None.

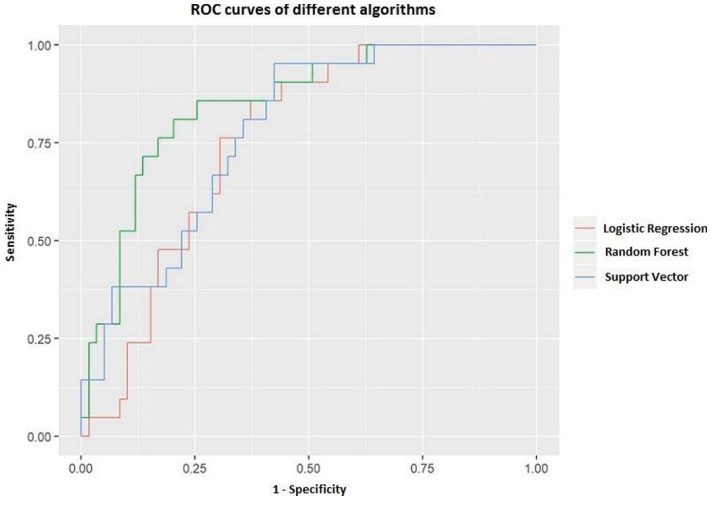
Introduction: Out of all patients admitted with Myocardial Infarction, 10 to 15% have Myocardial Infarction with Non-Obstructive Coronaries Arteries (MINOCA). Classification algorithms based on deep learning substantially exceed traditional diagnostic algorithms. Therefore, numerous machine learning models have been proposed as useful tools for the detection of various pathologies, but to date no study has proposed a diagnostic algorithm for MINOCA.

Purpose: The aim of this study was to estimate the diagnostic accuracy of several automated learning algorithms (Support-Vector Machine [SVM], Random Forest [RF] and Logistic Regression [LR]) to discriminate between people suffering from MINOCA from those with Myocardial Infarction with Obstructive Coronary Artery Disease (MICAD) at the time of admission and before performing a coronary angiography, whether invasive or not.

Methods: A Diagnostic Test Evaluation study was carried out applying the proposed algorithms to a database constituted by 553 consecutive patients admitted to our Hospital with Myocardial Infarction. According to the definitions of 2016 ESC Position Paper on MINOCA, patients were classified into two groups: MICAD and MINOCA. Out of the total 553 patients, 214 were discarded due to the lack of complete data. The set of machine learning algorithms was trained on 244 patients (training sample: 75%) and tested on 80 patients (test sample: 25%). A total of 64 variables were available for each patient, including demographic, clinical and laboratorial features before the angiographic procedure. Finally, the diagnostic precision of each architecture was taken.

Results: The most accurate classification model was the Random Forest algorithm (Specificity [Sp] 0.88, Sensitivity [Se] 0.57, Negative Predictive Value [NPV] 0.93, Area Under the Curve [AUC] 0.85 [CI 0.83–0.88]) followed by the standard Logistic Regression (Sp 0.76, Se 0.57, NPV 0.92 AUC 0.74 and Support-Vector Machine (Sp 0.84, Se 0.38, NPV 0.90, AUC 0.78) (see graph). The variables that contributed the most in order to discriminate a MINOCA from a MICAD were the traditional cardiovascular risk factors, biomarkers of myocardial injury, hemoglobin and gender. Results were similar when the 19 patients with Takotsubo syndrome were excluded from the analysis.

Conclusion: A prediction system for diagnosing MINOCA before performing coronary angiographies was developed using machine learning algorithms. Results show higher accuracy of diagnosing MINOCA than conventional statistical methods. This study supports the potential of machine learning algorithms in clinical cardiology. However, further studies are required in order to validate our results.



ROC curves of different algorithms