Detection of ST-Elevation Myocardial Infarction using an Artificial Intelligence-Guided Single Lead ECG

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Background

The electrocardiogram (ECG) is the main tool for cardiac electric anomalies. Several researchers have conducted groundbreaking experiments by applying AI to the ECG.

Door to balloon time (D2B) is an imperfect marker of AMI outcomes, instead, a rational approach is to achieve short symptom-to-balloon time (S2B).

AI-guided algorithms can provide point-of-care and accurate ECG interpretation that has the potential of improving patient management. The cumbersome and costly traditional 12-lead ECG relies completely on the interpretation of a cardiologist and may present accuracy variations that depend on the physician's expertise. We demonstrate the feasibility of an automated AI-guided single-lead ECG analysis for STEMI diagnosis.

Methods

Sample: 8,511 ECG anonymized records, previously diagnosed by cardiologists as "normal", "abnormal" (over 200 conditions excluding STEMI) or "STEMI" (4,255 cases).

The sample was derived from the private International Telemedical Systems (ITMS) database. Preprocessing: detection of QRS complexes by wavelet system, segmentation of each ECG into individual heartbeats with fixed window of 0.4s to the left and 0.9s to the right of main QRS; Classification: A 1-D convolutional neural network was implemented, "STEMI" and "Not-STEMI" classes were considered for each heartbeat, individual probabilities were aggregated to generate the final label for each record. Training & Testing: 90% and 10% of the sample were used, respectively.

Results

The AI model achieved a high level of accuracy, sensitivity, and specificity in comparison to the cardiologists' annotations.

Conclusion

AI-guided interpretation of the ECG is able to reliably detect STEMI;

AI algorithms can be incorporated into wearable devices for prehospital diagnosis, single page activation and, emergency department bypass, facilitating more efficient STEMI pathways and avoiding delays.

Performance Comparison: Machine Learning Model Vs Attending Physicians*

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