Pre-hospital prediction of transmural myocardial infarction and the need of acute coronary reperfusion by an artificial neural network compared to real-time prediction by a cardiac care unit physician

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Background

It is essential for patients with ST elevation / transmural myocardial infarction (TMI) to be rapidly transported to a PCI-facility for reperfu-sion therapy. Early detection of TMI is therefore of a great value. In Lund, the pre-hospital ECG is electronically transmitted from the ambulance to the physician on call in the cardiac care unit (CCU) for interpretation and triage decision. Cases of TMI are directly transferred to the PCI facility, bypassing the emergency department (ED). However, this system is not optimal, since the high volume of normal ECGs is time consuming for both the ambulance team and the CCU physician, and transport of TMI patients may be delayed if the CCU physician is not immediately available. Therefore, a computerized decision support system may be of value. The aim of this study was to compare the abilities of an ANN and the CCU physician on call to predict the discharge diagnosis of TMI and the need for immediate reperfusion therapy in pre-hospital chest pain patients.

Method

Seven hundred and forty-three patients were prospectively included of which 602 patients had an electronically saved ECGs. The ANN used has previously been shown to predict TMI in ECGs from ED chest pain patients with an accuracy at least similar to that of experienced cardiologists. The real-time interpretation by the CCU physician on call was prospectively recorded. The physician, but not the ANN, had access to the patient's symptoms via the ambulance team and to previous in-hospital patient records and ECGs. For the study, discharge diagnoses and reperfusion therapy data were retrieved from the in-hospital patient records and from the Swedish coronary angiography and angioplasty register. In the analysis, immediate reperfusion therapy was considered to be needed if coronary angioplasty or by-pass grafting were performed within 24 h.

Results

	TMI diagnosis	
	Sensitivity	Specificity
Artificial Neural Network	75%	80%
CCU physician	63%	97%

	Immediate PCI	
	Sensitivity	Specificity
Artificial Neural Network	59%	80%
CCU physician	55%	98%

Conclusion

Our ANN predicted TMI and the need of immediate reperfusion therapy with a higher sensitivity than the CCU physician on call.

Our ANN could thus be used as decision support in ambulances. The value would primarily be in ruling out TMI and the need of immediate reperfusion.

When the ANN suggests immediate reperfusion, the CCU physician would still have to be consulted in order to reduce unnecessary immediate PCIs.