Machine learning integration of SPECT myocardial perfusion imaging and clinical data in MACE

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Introduction

Implementation of machine learning (ML) algorithms in cardiology, particularly in the field of nuclear cardiology, has revolutionized individualized diagnosis and prognostic estimations of myocardial ischemia-related major adverse cardiovascular events (MACE).

The use of non-invasive, high-quality imaging via single-photon emission computed tomography (SPECT), together with clinical data, improves accuracy of diagnosis and prognosis of MACE compared to traditional methods.

Objective

Analyze the evidence for diagnostic and prognostic estimations of the combined use of SPECT myocardial perfusion imaging (MPI) and clinical data using ML.

Methods

A literature search of databases (e.g., PubMed and SpringerLink) was refined to identify reports of combined SPECT MPI and clinical data using ML focusing on diagnostic and prognostic values in MACE outcomes.

Studies

Author/year	Clinical variables	ML algorithm	Objective
Arsanjani et al., 2013	8	Boosting ensemble	Improve SPECT MPI diagnostic accuracy
Arsanjani et al., 2015	20	Boosting ensemble	Prediction of revascularization
Betancur et al., 2018	28	Boosting ensemble	Prediction of 3-year risk of MACE

ML data integration

Results

- ML diagnostic accuracy of coronary artery disease was superior to combined supine and prone total perfusion deficit (TPD) and to expert 2.
- ML predictive specificity for early revascularization was better than both expert readers and stress TPD.
- ML 3-year risk predictive accuracy of MACE was higher than MD diagnosis, automated stress TPD, and automated ischemic TPD.

ML Diagnostic Accuracy

** Significantly worse when compared to ML $p < 0.01$

Prediction of Revascularization

* Different from ML $p < 0.05$

Prediction of 3-year MACE

Conclusions

ML improved SPECT MPI diagnostic accuracy, and had a superior predictive accuracy for 3-year risk of MACE and for early revascularization after MPI.

The integration of MPI with clinical data via ML is shown to be equally as effective, and in some instances a superior method to generate individualized diagnosis and prognoses of MACE in patients undergoing SPECT MPI.

References

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