Fully automated artificial intelligence-based myocardial scar quantification for diagnostic and prognostic stratification in patients following acute myocardial infarction

Lange T.[1]; Stiermaier T.[2]; Backhaus SJ.[1]; Boom P.[1]; Kowallick JT.[3]; Lotz J.[3]; Kutty S.[4]; Bigalke B.[5]; Gutberlet M.[6]; De Waha-Thiele S.[2]; Desch S.[7]; Hasenfuss G.[1]; Thiele H.[7]; Eitel I.[2]; Schuster A.[1]

[1]University Medical Center Goettingen (UMG), Department of Cardiology and Pneumology and German Center for Cardiovascular Research (DZHK), Goettingen, Germany
[2]University Heart Center, Medical Clinic II (Cardiology/Angiology/Intensive Care Medicine), Luebeck, Germany
[3]University Medical Center Goettingen (UMG), Department of Diagnostic& Interventional Radiology, German Center for Cardiovascular Research (DZHK), Goettingen, Germany
[4]Johns Hopkins University School of Medicine, Helen B. Taussig Heart Center, Baltimore, United States of America
[5]Charite - Campus Benjamin Franklin, Department of Cardiology , Berlin, Germany
[6]University of Leipzig, Institute of Diagnostic and Interventional Radiology, Leipzig, Germany
[7]Heart Center of Leipzig, Department of Internal Medicine/Cardiology, Leipzig, Germany

Background Myocardial infarct size (IS) remains one of the strongest predictors of adverse cardiac events following acute myocardial infarction (AMI). Late gadolinium enhancement (LGE) cardiac magnetic resonance (CMR) can precisely quantify the extent of injury but requires manual post-processing. Whether novel user-independent artificial intelligence (AI) based fully-automated analyses may facilitate clinical workflow and deliver similar information for risk stratification is unknown.

Methods 913 AMI patients from two multi-center trials (AIDA-STEMI n = 704 with ST-elevation myocardial infarction [STEMI] and TATORT-NSTEMI n = 245 with non-ST-elevation-infarction [NSTEMI]) were included in this sub-study. IS was quantified manually using conventional software (Medis, Leiden Netherlands) and fully automated AI-based software (NeoSoft). All automatically detected IS were evaluated visually and corrected if necessary. Analyzed data were tested for agreement and prediction of major adverse clinical events (MACE) within one year after AMI.

Results Automated and manual IS were similarly associated with outcome in cox regression analyses (HR 1.05 [95% CI 1-02-1.07] p < 0.001 for automated IS and HR 1.04 [95% CI 1.02-1.06]; p < 0.001 for manual IS). Comparison of C-statistics derived area under the curve (AUC) resulted in equivalent MACE prediction (AUC 0.65 for automated vs. AUC 0.66 for manual, p = 0.53). Manual correction of the automated scar detection did not lead to an improved risk prediction of MACE (AUC 0.65 to 0.66, p = 0.43). There was good agreement of automated and manually derived IS (intraclass correlation coefficient [ICC] 0.75 [0.07-0.89]) which was further improved after manual correction of the underlying contours (ICC 0.98 [0.97-0.98]).

Conclusion AI-based software enables automated scar quantification with similar prognostic value compared to conventional methods in patients following AMI.