Cardiac troponin assay for myocardial infraction diagnostics

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Aim of the study

The aim of this study was to develop an immunoassay that detects cardiac troponin from patient samples.

Background

- Myocardial infraction (MI), commonly known as “heart attack”, is one of the leading causes of death in the developed world.
- MI occurs when blood flow to a section of cardiac muscle becomes disturbed.
- MI Diagnosis is based on symptoms, electrocardiogram, and cardiac troponin T or I assay.
- Cardiac troponins are released to the circulation from cardiac muscle tissue during MI.
- Assays that measure cardiac troponin I and T from blood samples are critical in confirming or excluding MI according to universal definition of MI.

Methods

- A novel sandwich-type fluorometric immunoassay was developed with antibodies specifically detecting cardiac troponin.
- Various antibody combinations, buffer additives and protocol variations were tested to optimize the assay.
- The best antibody and buffer composition was selected for larger scale performance evaluation using heparin plasma samples from ST-elevation myocardial infarction (STEMI) patients (n=79), non-ST-elevation myocardial infarction (NSTEMI) (n=67) patients and dialysis (DIAL) patients (n=66).

Results

- Preliminary testing results indicated that the best antibody composition was with three tracer antibodies and one capture antibody.
- Assay optimization remediated matrix interference. (Fig. 1)
- The analytical sensitivity of the assay was 8 ng/L. High variation at low concentrations limited the analytical sensitivity of the assay (Fig. 2)
- cTnT levels were higher in STEMI and NSTEMI patients than in dialysis patients. (Fig. 3)
- The assay discriminated well between MI patients and dialysis patients with a clinical sensitivity of 85% and specificity of 86% at 9 ng/L (Fig. 4)

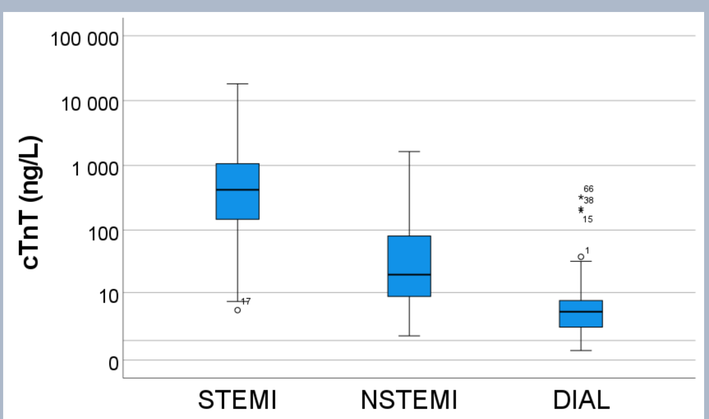

Fig. 3. cTnT concentrations measured with the optimized assay in the samples of STEMI, NSTEMI and DIAL patients.

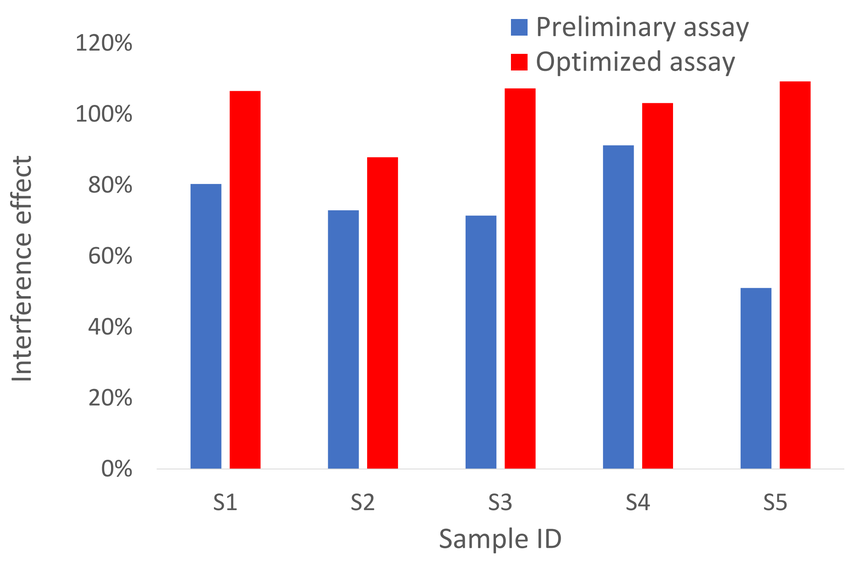

Fig. 1. Sample matrix interference with preliminary assay format and optimized assay format in single STEMI samples.
Interference effect has been calculated as the measured concentration of an undiluted sample divided by the concentration of undiluted sample calculated from the result of a diluted sample. A result of 100% is expected for an assay without matrix interference. Lower percentage indicates that in undiluted samples matrix interference prohibits efficient detection of the analyte.

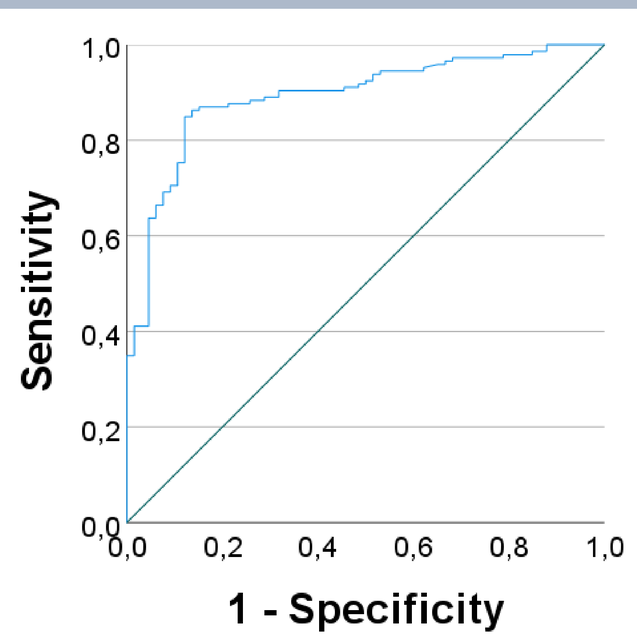

Fig. 4. ROC curve of the optimized assay for discrimination of MI patients (STEMI and NSTEMI) from DIAL patients (AUC=0,893).

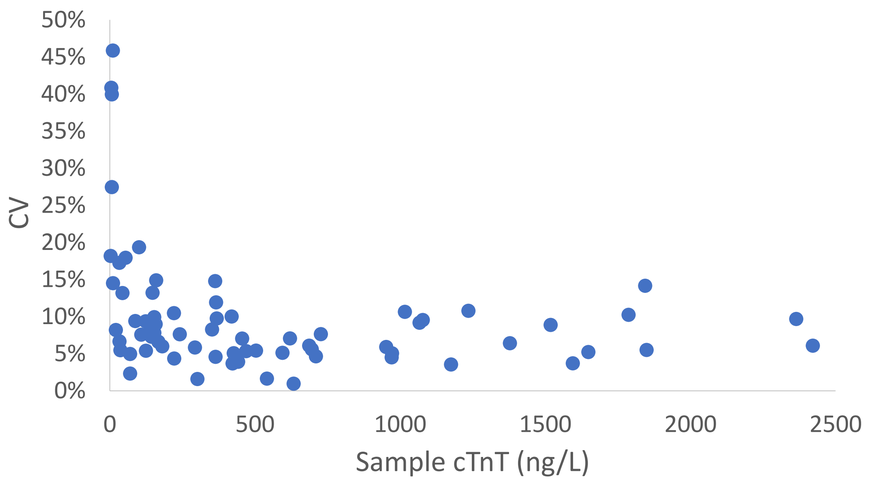

Fig. 2. Imprecision profile of the optimized assay.

Conclusion

- This assay shows great potential and could be useful in diagnosing MI.
- Further development of the assay is required to improve analytical sensitivity.

Acknowledgment

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