LS25-030 - Cell-Free DNA Liquid Biopsies for Precision Cardiovascular Medicine

Zusammenfassung

Acute myocardial infarction (AMI) is a leading cause of death. Moreover, it causes long-term disability due to adverse ventricular remodeling and progression to heart failure. The heterogeneous nature of AMI recovery underscores the need for precision medicine approaches that enable early risk stratification and personalized intervention. Existing biomarkers including troponin and pro-BNP lack precision and cannot provide mechanistic insight into disease progression [1]. We will develop and validate a cell-free DNA (cfDNA) based liquid biopsy assay that captures molecular signatures of vessel occlusion, myocardial injury and cardiac remodeling for early risk stratification, guiding targeted therapy before irreversible progression to heart failure [2]. Establishing a molecular basis for liquid biopsy in AMI, Aim 1 investigates cfDNA release and degradation and builds a cardiovascular DNA methylation reference. Aim 2 applies liquid biopsy to a well-characterized AMI cohort, develops a scalable diagnostic assay, and validates it in independent cohorts. We will employ a multimodal deep learning framework to integrate cfDNA features at single-fragment resolution [3], connecting mechanistic insights with patient-level risk stratification and enable clinically meaningful interpretation of cfDNA in AMI. Together, these efforts will catalyze a new era of precision cardiovascular medicine by establishing cfDNA liquid biopsy as a mechanistically informed and clinically actionable tool that enables early risk stratification for personalized therapy and targeted enrollment for precision medicine trials (e.g., anti-IL1?, anti-IL6, nuclease-based, or anti-remodeling), driving both scientific discovery and transformative patient care.

Wissenschaftliche Disziplinen:
Cardiology (40%) | Genomics (30%) | Bioinformatics (30%)

Keywords:
Precision medicineCardiovascular diseaseAcute myocardial infarctionCell-free DNA (cfDNA)EpigenomicsLiquid biopsyDNA methylationFragmentomicsInflammationThrombosisImmunothrombosisFibrosis

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Weiterführende Links zu den beteiligten Personen und zum Projekt finden Sie unter
https://www.wwtf.at/funding/programmes/ls/LS25-030/