Advancing Multi-Cancer Early Detection: High-Performance Cell-Free Rna Profiling With The Flomics Liquid Biopsy Platform

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Abstract

Background

Liquid biopsies are emerging as crucial tools for early cancer detection due to their high sensitivity and minimal invasiveness, with cell-free RNA (cfRNA) serving as a promising biomarker. Flomics Biotech has developed a robust cfRNA-Seq platform that integrates optimized laboratory protocols, next-generation sequencing, and machine learning (ML) to identify cancer-related RNA signatures.

Objective

This study aims to evaluate the performance of the Flomics cfRNA-Seq platform in detecting multiple cancer types at early stages within the LiquiDx pre-clinical study.

Methods

Plasma cfRNA from over 1,000 individuals (median age = 64 years) was profiled using our cfRNA-Seq pipeline. The cohort included patients with colorectal, lung, breast, pancreatic, or prostate cancer across stages, as well as non-cancer patients and healthy individuals. Total RNA was extracted from 1 mL of plasma and sequenced at an average depth of 36M reads per sample using Illumina technology.

We identified differentially expressed genes (DEGs), performed gene set enrichment analysis (GSEA), and trained an ML classifier to predict patient status and cancer tissue of origin. A stratified 4-fold cross-validation approach was employed to maintain class balance, optimizing model hyperparameters.

Results

A total of 114 DEGs ($|log2FC| > 1$, $FDR < 0.05$) were identified, with GSEA highlighting enrichment in metastasis, inflammation, and proliferation-associated genes in cancer patients. The ML classifier achieved a mean area under the ROC curve of 0.92 ± 0.01 and an 83% sensitivity at 90% specificity for cancer vs. healthy classification. For cancer type classification, sensitivity at 90% specificity ranged from 69% (breast cancer) to 99% (prostate cancer). Importantly, our platform maintains 80% sensitivity for stage I cancers, outperforming current liquid biopsy approaches.

Conclusion

The Flomics cfRNA-Seq platform provides high-quality cfRNA data and robust biomarker identification, demonstrating strong potential for multi-cancer early detection, including stage I cancers. Its high accuracy and non-invasive nature position it as a transformative tool for improving global cancer diagnostics.

Do you have any conflicts of interest?

No, I do not have a conflict of interest.