Label-free Acute Leukemia Diagnosis from Exosome with SERS and Artificial Intelligence

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Extended Abstract

Liquid biopsy has emerged as a revolutionary non-invasive technique for early cancer diagnosis and monitoring by analysing various biomarkers present in bodily fluids such as blood, urine, and saliva. Among the biomarkers, exosomes are small extracellular vesicles secreted by various cell types. Exosomes carry a diverse cargo of nucleic acids, proteins, and lipids, reflecting the molecular makeup of their parent cells. They are released into the bloodstream, urine, and other bodily fluids, making them easily accessible for analysis. The study of exosome contents in liquid biopsy holds promise in the early detection of cancers, monitoring of disease progression, and assessment of therapeutic responses. Surface-enhanced Raman spectroscopy (SERS), which enhanced Raman signals by interaction of plasmonic nanostructures with an analyte, offers a promising approach to enhance sensitivity and specificity of exosome analysis. By analysing various biomarkers with SERS and machine learning, we can increase accuracy of liquid biopsy and improve our ability to diagnose disease. In this study, we aimed development of new approaches for detecting exosomes related to acute leukemia by combining SERS and artificial intelligence. To investigate the potential of using SERS and artificial intelligence, exosomes related to acute leukemia were isolated collecting serum samples from patients with acute leukemia patients and healthy individuals. The isolated exosome samples were dropped onto an AuNPs-based SERS substrate to collect SERS spectra. To discriminate between the groups, unique spectral profiles of exosomes will be defined, and machine learning algorithms will be used to classify the exosomes. Consequently, SERS and machine learning provide a rapid, low-cost, and promising tool for detection of exosomes related to acute leukemia.

Keywords: exosomes, acute leukemia, Surface-enhanced Raman Spectroscopy, artificial intelligence