

Title: "CTC characterization and applications."

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Liquid biopsy provides a valuable source of biomarkers through simple and minimally invasive serial blood draws and represents a highly dynamic diagnostic, prognostic and theranostic tool for the management of cancer patients. Circulating tumor cells (CTCs) are major players in liquid biopsy and their presence has been linked to worse prognosis and early relapse in numerous clinical studies. CTC molecular characterization offers an exciting approach to monitor the efficacy of systemic therapies in real-time, unravel the biology of cancer cell dissemination, understand resistance to established therapies and identify gene targets and signaling pathways relevant to therapeutic interventions. Single-cell CTC analysis is a powerful tool to understand tumor heterogeneity and the mechanisms involved in cancer progression with potential implications for improving treatment strategies. However, there are still some barriers to the establishment of CTCs in routine clinical use: 1. The numerous technologies available for their detection and characterization should be standardized and clinically validated, 2. The number of biomarkers for evaluation in CTCs is constantly increasing while the amount of sample is limited; 3. pre-analytical phases must be standardized in order to obtain robust and reproducible results; 4. the turnaround time of CTC analysis is currently slow. This overview is focused on the latest developments in the detection and molecular characterization of CTCs, and their clinical applications in many types of cancer.