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Liquid Biopsy as a Non-Invasive Tool for Cancer Screening and Monitoring.

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Introduction

Cancer remains one of the leading causes of mortality worldwide, with early detection and effective monitoring being crucial for improving patient outcomes. Traditional diagnostic methods, such as tissue biopsy, though reliable, are invasive, costly, and not always feasible for repeated sampling. In recent years, liquid biopsy has emerged as a transformative, non-invasive diagnostic approach for cancer screening and monitoring. This method involves analyzing circulating tumor DNA (ctDNA) [1, 2, 3, 4, 5], circulating tumor cells (CTCs), and other cancer-derived biomarkers present in body fluids like blood, urine, or saliva. By enabling real-time tracking of tumor dynamics, liquid biopsy offers significant advantages in terms of patient comfort, early detection, minimal risk, and the potential for guiding personalized treatment strategies. The technique also facilitates detection of minimal residual disease and monitoring of treatment resistance, making it an invaluable tool in precision oncology.

Conclusion

Liquid biopsy represents a paradigm shift in cancer diagnostics and monitoring, offering a safer, faster, and more patient-friendly alternative to traditional tissue biopsy. Its ability to detect cancer-specific genetic and epigenetic alterations at an early stage holds promise for improving survival rates through timely interventions. Moreover, its utility in longitudinal disease monitoring allows clinicians to adapt treatment strategies based on real-time tumor evolution. While challenges such as standardization, sensitivity, and cost-effectiveness remain, ongoing research and technological advancements are rapidly enhancing its clinical applicability. As liquid biopsy continues to mature, it is poised to become an integral component of routine cancer care, revolutionizing how cancers are detected, monitored, and managed in the future.

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