

Transforming Cancer Patient Management: The Intersection of AI and Liquid Biopsy

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Artificial intelligence (AI) and liquid biopsy are revolutionizing cancer patient management by enabling early detection, personalized treatment, and real-time monitoring. Integrating multimodal liquid biopsy features is essential in this process by combining different biomarkers—such as circulating cell-free/tumor DNA (cf/ctDNA), circulating tumor cells (CTCs), extracellular vesicles, and proteins, thus providing a more comprehensive view of tumor biology. AI tools allow this process by rapidly analyzing complex omics data, identifying patterns, and predicting treatment responses with unprecedented accuracy. Thus, increasing diagnostic preciseness, reducing false negatives, and capturing tumor heterogeneity, which single-marker tests may miss. However, the process faces several key challenges, including data accuracy and standardization, as variability in sample collection, processing, and analysis affects consistency and reliability. Importantly, AI-driven integration demands extensive validation to minimize errors and biases, reducing the risk of false positives or negatives and ensuring reliable clinical decision-making. Overcoming these challenges is crucial for translating multimodal liquid biopsy into routine clinical practice. The intersection of AI-driven insights and advancements in liquid biopsy in oncology care is shifting towards a more proactive, efficient, and patient-centered approach, redefining cancer diagnosis, treatment, and surveillance.