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LIQUID BIOPSY WHITE PAPER

The importance of early integration of liquid biopsy to enhance oncology research

Traditional tissue biopsy has long been central to oncology. These procedures provide essential insights into tumor biology, but they also have several notable limitations, including patient discomfort due to the invasive nature of the procedure. Traditional biopsy also struggles to capture tumor heterogeneity, and there is limited feasibility for repeat testing. The constraints reduce the utility of this technology for real-time monitoring and treatment assessment.

How can researchers expand their view of tumor biology and unlock new options for personalization? Liquid biopsy is one powerful option. This non-invasive approach analyzes circulating tumor DNA (ctDNA), circulating tumor cells (CTCs) and other tumor-derived biomarkers in biofluids such as blood, urine and cerebrospinal fluid.[1] This technology could enable adaptive clinical trial designs, enhance precision oncology and accelerate drug development. As a result of these benefits, integration of liquid biopsy in oncology research is growing.

Liquid biopsy's advantages

Through a simple sample collection process, liquid biopsy improves patient selection, refines trial design and tracks treatment response.

Accelerating biomarker identification

The future of targeted therapies relies on identification and validation of biomarkers. Liquid biopsy allows researchers to achieve this non-invasively,[2] enabling:

- Earlier drug target identification
- Patient selection based on molecular signatures rather than broad clinical criteria
- Real-time monitoring of drug effectiveness

Reducing invasiveness

Traditional biopsy can be painful, costly and logistically challenging, particularly for tumors in hard-to-access areas. Liquid biopsy is more minimally invasive and can reduce patient burden and the need for repeated surgical procedures. In addition to improving patient comfort, this can enhance trial recruitment and retention, particularly for those who cannot or do not wish to undergo surgical biopsy.

Enhancing clinical trial design

Treatment success in precision oncology research depends on identifying the right patients for the right therapies. By facilitating biomarker-driven patient selection, liquid biopsy enables more adaptive trial designs that modify drug doses or switch therapies based on emerging resistance.[3] As a result of this increased efficiency, early adoption of liquid biopsy can decrease overall costs while ensuring patients receive the most appropriate care.

Monitoring in real-time

Liquid biopsy provides a window into treatment response as it happens. Monitoring ctDNA levels enables rapid assessment of whether a therapy is working, while detection of minimal residual disease (MRD) can identify lingering cancer cells that may lead to relapse and can spot resistance mutations before they become clinically apparent.[4]

Implementation challenges and considerations

Although there are many benefits to liquid biopsy, it is not without challenges. These must be addressed to ensure trial efficiency and the reliability of results.

Complex analysis process

Because biofluid analysis involves such faint signals, it is more complex than traditional tissue biopsy. This is especially true for early-stage cancers where ctDNA levels are lower. As a result, researchers often must use highly sensitive arrays. However, this introduces a new challenge: distinguishing true cancer signatures from bloodstream background noise.[5] Additionally, not all genetic variations detected are clinically significant, necessitating careful interpretation to determine their impact on disease progression and treatment response.[6]

Comprehensive profiling

Tumors are always evolving. The genetic material they shed into a patient's bloodstream represents only a snapshot of their molecular molecule. This means that while liquid biopsy is useful for providing a broad molecular view, it may not always capture the full heterogeneity of cancer cells, especially when crucial mutations only exist in a small portion of cancer cells.[5] In some cases, traditional tissue sampling may still be necessary to obtain a complete picture of spatial and temporal changes in tumor composition.

Standardization

The task of preserving data integrity starts the moment a clinician collects a biofluid sample. Pre-analytical variables like sample processing speed or DNA extraction method can introduce inconsistencies early. As analysis progresses, failure to standardize across laboratories further increases variations, which can complicate reproducibility.[6] To address these issues, researchers must implement consistent methodologies and standardized protocols, and the effort needs to be industry-wide.

Regulatory changes

Despite increasing adoption, regulatory evaluation of liquid biopsy is ongoing. For it to be approved by the FDA and other regulatory bodies as a stand-alone diagnostic tool or trial enrollment criterion, further evidence of clinical utility will be necessary.[6] Additionally, agencies have yet to reach consensus on uniform guidelines, and discrepancies can cause variability and complicate cross-study comparisons. Continued collaboration between researchers and regulatory bodies is essential for advancing the field.

Accessibility and scalability

Broader use of liquid biopsy is on the horizon, but it is not yet a reality. Reimbursement policies vary, and many health systems do not have the infrastructure to implement this technology at scale.[6] As research continues, true progress will require broadening accessibility so patients can access this technology in diverse settings, not just at major cancer centers.

Liquid biopsy's future in oncology research

Liquid biopsy could soon expand beyond mutation detection, with promise to facilitate earlier cancer detection and improve treatment personalization. Thanks to advances in sequencing sensitivity, researchers can more easily identify cancer-related biomarkers at lower levels. As these improvements continue, they could change how soon oncologists can intervene and to what extent they can personalize treatment protocols.[2]

Multi-cancer early detection (MCED) is one of the most promising frontiers for liquid biopsy. This type of screening covers multiple cancer types and can be used for asymptomatic patients. Although they are still in clinical development, future ctDNA-based liquid biopsies could complement standard cancer screening.[4]

In precision oncology, liquid biopsy is already enabling adaptive trial designs. As data are gathered to support the ability to monitor a tumor's molecular evolutions, this could become part of clinical practice, resulting in more flexible and responsive treatment.

To bring these advances to more patients, standardization of protocols, improved regulatory clarity and increased accessibility are all necessary. However, the future is bright for liquid biopsy in both clinical research and routine cancer care and detection.

Fortrea's Diagnostics Center of Excellence

Successful implementation of liquid biopsy in oncology research requires expertise in regulatory strategy, operational execution and diagnostic validation. Fortrea's Diagnostics Center of Excellence provides the guidance and infrastructure you need to integrate liquid biopsy effectively into clinical trials.

Our team of experts supports sponsors from early study design through ongoing regulatory and operational execution. With oncology IVD (*in-vitro* diagnostic) experience spanning 12 studies, 450 sites and more than 91,500 patients, we ensure your trials are designed for efficiency, compliance and scientific rigor.

Ready to optimize your liquid biopsy strategy?
Connect with us today.

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