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Journal of Medical Diagnostic Methods

Commentary

Liquid Biopsy using Aptamers

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COMMENTARY

Liquid biopsy enables for noninvasive and real-time investigation of tumor-derived circulating targets in body fluids, which has significant implications for cancer diagnosis, prognosis, customised therapy, and the understanding of carcinogenesis and progression mechanisms. Liquid biopsy, on the other hand, faces formidable technological obstacles because to the low concentration and variety of circulating targets, as well as the complexity of physiological fluids. Aptamers with a variety of unique characteristics are being examined as potential liquid biopsy recognition ligands. Because of their simplicity of modification and affinity regulation, they can be used to provide a variety of platforms for the effective isolation and release of circulating targets. Aptamers offer a variety of methodologies for sensitive detection and analysis of circulating targets, thanks to their diverse structural design and engineering. Recent advances in aptamer-based liquid biopsy are summarised in this review, with an emphasis on the isolation and detection of Circulating Tumour Cells (CTCs) and Extracellular Vesicles (EVs). First, new methodologies for generating aptamers against circulating targets are discussed, and existing aptamers that have been effectively used in liquid biopsy are thoroughly reviewed, including their targets, sequences, and affinities. The following section summarises aptamer-based methodologies for CTC separation, release, and analysis. The use of aptamer-mediated signal transduction and amplification to detect EVs is also discussed. Finally, the field's difficulties and future prospects are examined.

Cancer is one of the top causes of morbidity and mortality around the world, particularly in developing nations. Early detection and effective treatment are critical for improving cancer patient outcomes. Tissue biopsy, on the other hand, is the gold standard for cancer diagnosis, although it has poor accuracy and requires intrusive sampling. On the one hand, a tissue biopsy is only performed after medical imaging has shown mass lesions, resulting in tumours being diagnosed too late for effective treatment. Tissue biopsy, on the other hand, is the gold standard for cancer diagnosis, despite its low accuracy and intrusive sampling requirements. On the one hand, a tissue biopsy is only done after medical imaging has revealed mass lesions, resulting in tumours being detected too late to be treated effectively. Tissue biopsy, on the other hand, necessitates tissue from invasive surgery or fine-needle aspiration, limiting its use as a routine disease screening or real-time therapy monitoring tool. Tissue biopsy, on the other hand, only represents histological or molecular information on a piece of the material at a given moment, making it impossible to obtain full and valid biological data. As a result, developing an alternative to tissue biopsy that is capable of early and noninvasive cancer diagnosis with real-time and comprehensive information for better cancer care is highly desirable.

To address these concerns, liquid biopsy was developed as a noninvasive disease diagnostic and monitoring tool that detects and analyses circulating targets shed or secreted from solid tissues in body fluids. The most promising "liquid biopsy" tool for cancer precision therapy is the examination of tumor-derived circulating targets, such as circulating tumour cells, extracellular vesicles, and cellfree circulating tumour DNA (ct-DNA). Compared to standard tissue biopsy, liquid biopsy has a number of advantages. For starters, noninvasive sampling allows for real-time and dynamic monitoring of tumour growth and treatment response. Second, circulating tumour targets could be created at an early stage of tumour development, allowing for early cancer detection. Third, liquid biopsy provides detailed information on both primary and metastatic cancers, allowing for more tailored and accurate cancer treatment. In addition, given the variability of circulating targets, it is critical to examine them at the single-cell/EV level.

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Received date: July 05, 2021; **Accepted date:** July 15, 2021; **Published date:** July 31, 2021

Citation: Edward E (2021) Liquid Biopsy using Aptamers. J Med Diagn Meth.10:343.