

Aptamer-Based Tumor-Targeted diagnosis and drug delivery

Woldekidan, Haregewoin B; Woldesemayat, AA; Adam, G; Tafesse, Mesfin; Thimiri Govindaraj, Deepak B

Abstract

Early cancer identification is crucial for providing patients with safe and timely therapy. Highly dependable and adaptive technologies will be required to detect the presence of biological markers for cancer at very low levels in the early stages of tumor formation. These techniques have been shown to be beneficial in encouraging patients to develop early intervention plans, which could lead to an increase in the overall survival rate of cancer patients. Targeted drug delivery (TDD) using aptamer is promising due to its favorable properties. Aptamer is suitable for superior TDD system candidates due to its desirable properties including a high binding affinity and specificity, a low immunogenicity, and a chemical composition that can be simply changed. Due to these properties, aptamer-based TDD application has limited drug side effect along with organ damages. The development of aptasensor has been promising in TDD for cancer cell treatment. There are biomarkers and expressed molecules during cancer cell development; however, only few are addressed in aptamer detection study of those molecules. Its great potential of attachment of binding to specific target molecule made aptamer a reliable recognition element. Because of their unique physical, chemical, and biological features, aptamers have a lot of potential in cancer precision medicine. In this review, we summarized aptamer technology and its application in cancer. This includes advantages properties of aptamer technology over other molecules were thoroughly discussed. In addition, we have also elaborated the application of aptamer as a direct therapeutic function and as a targeted drug delivery molecule (aptasensor) in cancer cells with several examples in preclinical and clinical trials.