DOCTORAL THESIS

Lanthanide-based nanomaterials for imaging and inhibition of EBV-related cancers

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ABSTRACT

Nasopharyngeal Carcinoma (NPC) as a typical malignancy that occurs in high-incidence areas, e.g. southern China region, including Hong Kong, and it has aroused wide interests for local researchers to study. The Epstein-Barr virus (EBV) was reported as a vital herpes virus for the growth of NPC. Two significant proteins in EBV, namely Epstein-Barr Nuclear Antigen 1 (EBNA1) and latent infection membrane protein 1 (LMP1) are crucial for virus maintenance and EBV-infected cell development, and essential for cell proliferation and differentiation of EBV latent life cycle, respectively. Thus, inhibition of EBNA1 and LMP1 can be regarded as effective and potent therapy on EBV-associated cancers.

In this thesis, the conjugation of core-shell structured upconversion nanoparticles (UCNPs) with distinct EBV-specific peptides including EBNA1 and LMP1 targeting peptides to achieve both impressive inhibition on EBV-positive cancers *in vitro*/*in vivo* and visualization on EBV-positive cells with responsive upconversion emission signals were investigated. Taking advantage of lanthanide-based UCNPs, their unique photophysical properties offer deep tissue penetration depth, negligible photobleaching and photocytotoxicity, and therefore provides a solid foundation for convincible theranostic studies. Furthermore, desired inhibitory performance was achieved, it was shown that ~50 μg/mL of nanoprobes can inhibit half of EBV-infected cell viability and only 0.25 mg/tumor of nanoprobes dosage *via* intravenous injection can prohibit 64.7% of growth inhibition of an EBV-positive tumor.

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