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Nanobubbles Provide Theranostic Relief to Cancer Hypoxia

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ABSTRACT

Hypoxia is a common motif among tumors, contributing to metastasis, angiogenesis, cellular epigenetic abnormality, and resistance to cancer therapy. Hypoxia also plays a pivotal role in oncological studies, where it can be used as a principal target for new anti-cancer therapeutic methods. Oxygen nanobubbles were designed in an effort to target the hypoxic tumor regions, thus interrupting the hypoxia-inducible factor-1 α (HIF-1 α) regulatory pathway and inhibiting tumor progression. At less than 100nm, oxygen nanobubbles act as a vehicle for site-specific oxygen delivery, while also serving as an ultrasound contrast agent for advanced imaging purposes. Through *in vitro* and *in vivo* studies, it was shown the reversal of 5mC hypomethylation was achieved in the hypoxia-afflicted regions. An obvious increase in the oxygen concentration within hypoxic regions was also observed, implying adequate oxygen dissociation from the nanobubbles to the hypoxic tumor microenvironment. These implications suggest nanobubbles can be used as a means for epigenetic regulation, ultrasound imaging, and cancer therapeutics, thus having a significant impact on new-age cancer treatment methods in oncology.

KEYWORDS

Nanobubbles, Cancer, Epigenetics, Hypoxia, Imaging