Enhancing radiation therapy sensitivity by overcoming tumor hypoxia

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Technology description

PAGE SUMMARY
Biomedical engineers and physicians at Drexel University and The Thomas Jefferson University have developed a new method for targeted delivery of oxygen to solid tumors to enhance the sensitivity of radiation therapy.
Focused radiation therapy is frequently used in the treatment of breast and numerous other cancers to both eradicate the primary tumor and prevent metastasis. Unfortunately, rapidly growing tumors outpace their blood supply rendering them hypoxic, thus making malignant tissue more resistant to radiotherapy than healthy tissue. This resistance has been shown to result in decreased response to radiation therapy as well as a higher likelihood of recurrence and metastasis. Systemic approaches for oxygen (O2) delivery using hyperbaric chambers for overcoming tumor hypoxia have shown some promise, but this becomes technically challenging in conjunction with radiation therapy from a temporal standpoint and localized changes in oxygenation levels have been modest.
To achieve efficient locally delivery of O2 directly to the tumors, the researchers have developed injectable microbubbles that are filled with O2. When injected intravenously, these 1-8 μm O2-filled agents are restricted to the vasculature and tend to accumulate within tumors due to their leaky vasculature. Following this injection, clinically approved doses of focused ultrasound can be used to locally and noninvasively rupture these bubbles, releasing oxygen inside the tumor and thus significantly sensitizing the tumor to the damaging effects of ionizing radiation. This approach can be used to eliminate tumor hypoxia onsite immediately prior to administering radiation therapy and thus significantly improve tumor response to the treatment.
Additionally, such O2-containing microbubbles can serve as ultrasound contrast agent that helps to visualize the tumor and help improve focusing radiation therapy beam on the tumor.

Application area

Overcoming tumor hypoxia
Tumor visualization capability afforded by the same agent

Advantages

Convenient, non-invasive enhancement of radiation therapy
Improved targeting of radiotherapy when combined with ultrasound imaging

Institution

Drexel University

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