Nanoparticles for Imaging and Treatment of Brain Tumors

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Technology description

Summary

Malignant brain tumors, whether arising within the brain or invading the brain from other tissues, are difficult to treat. Conventional chemotherapy drugs do not reach therapeutic levels in brain tumor tissue, and do not remain in brain tumor tissue for long enough to enter brain tumor cells and kill them. As a consequence, these chemotherapy drugs are not effective at treating malignant brain tumors growing in patients, even though these drugs are effective at killing brain tumor cells growing in culture.

This invention claims that intravenously administered functionalized polyamidoamine (PAMAM) dendrimers of certain sizes can selectively cross the blood-brain barrier (BBB) of malignant brain tumors, and can accumulate over time within individual brain tumor cells. Gadolinium and fluorescent probe conjugated dendrimers with these properties can be used for simultaneous magnetic resonance and fluorescence imaging of brain tumor cells. Since these nanoparticles possess numerous additional surface functional groups, in addition to being useful for multi-modality imaging, functionalized dendrimers can also be useful for the simultaneous delivery of cytotoxic drugs and inhibitors of tumor cell metabolic or migratory pathways.

Market:

In 2008, it is estimated that malignant tumors of the brain and spinal cord will account for about 1.5% of all cancers and 2.3% of all expected cancer-related deaths.

Application area

Anatomic and metabolic imaging of brain and spinal cord tumors for diagnostic and therapeutic purposes

Intravenous treatment of brain and spinal cord tumors

Imaging of intravenous drug delivery to brain and spinal cord tumors

Potential to be used for imaging and treatment of other neurological disorders in which the BBB becomes porous

Advantages

Intravenously administered nanoparticles selectively cross the BBB of brain tumors and accumulate within brain tumor cells but not normal brain cells
Nanoparticles accumulate in and are retained in brain tumor tissue for long enough to result in the effective uptake of nanoparticles by individual brain tumor cells
Nanoparticle size can be adjusted to achieve the desired particle blood half-life
A wide variety of agents can be attached to the functional groups on the nanoparticle exterior

Institution

NIH - National Institutes of Health

联系我们

叶先生

电 话：021-65679356
手 机：13414935137
邮 箱：yeyingsheng@zf-ym.com