Gadolinium-G6 dendrimer-Cy5.5

Gd-G6-Cy5.5

Kam Leung, PhD[1]

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Chemical name:	Gadolinium-G6 dendrimer-Cy5.5	
Abbreviated name:	Gd-G6-Cy5.5	
Synonym:		
Agent category:	Macromolecule, polymer	
Target:	Non-targeted	
Target category:	Non-targeted	
Method of detection:	Magnetic resonance imaging (MRI), optical, near-infrared (NIR) fluorescence imaging	
Source of signal/contrast:	Cy5.5, gadolinium (Gd)	
Activation:	No	
Studies:	• *In vitro* • Rodents	No structure is available in PubChem.

Background

[PubMed]

Optical fluorescence imaging is increasingly being used to monitor biological functions of specific targets in small animals (1-3). However, the intrinsic fluorescence of biomolecules poses a problem when fluorophores that absorb visible light (350–700 nm) are used. Near-infrared (NIR) fluorescence (700–1,000 nm) detection avoids the natural background fluorescence interference of biomolecules, providing a high contrast between target and background tissues in small animals. NIR fluorophores have a wider dynamic range and minimal background fluorescence as a result of reduced scattering compared with visible fluorescence detection. NIR fluorophores also have high sensitivity, attributable to low

[1] National for Biotechnology Information, NLM, NIH, Bethesda, MD; Email: MICAD@ncbi.nlm.nih.gov.

Corresponding author.

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background fluorescence, and high extinction coefficients, which provide high quantum yields. The NIR region is also compatible with solid-state optical components, such as diode lasers and silicon detectors. NIR fluorescence imaging is a non-invasive alternative to radionuclide imaging in small animals.

The sentinel lymph node (SLN) is considered to be the first lymph node to receive lymphatic flow from tumor sites and therefore will contain metastatic tumor cells (4). SLN mapping has been used in the diagnosis of metastasis of solid tumors (5). Radical lymph node dissection is performed in patients with malignant cells in the SLNs. SLN mapping is currently performed by a combination of radioactive tracer and blue dye with low spatial resolution. The current procedure is time-consuming and requires a steep learning curve. NIR quantum dots (QDs) have been studied in SLN mapping in small animals (6, 7). However, there are only limited studies of long-term toxicity of QDs in animals (8). Dendrimer consists of a core with concentric annular shells or generations (G1–G6) made of highly branched polymers, which contain numerous surface functional groups for additional modifications. Koyama et al. (9) prepared a G6 dendrimer tagged with Cy5.5 and gadolinium (Gd) for optical NIR fluorescence and magnetic resonance (MR) multimodal imaging of the SLNs.

Synthesis

[PubMed]

G6 dendrimer (~9 nm in diameter) was conjugated with a two-fold molar excess of the bifunctional chelating agent 1B4M-diethylenetriaminepentaacetic acid (1B4M-DTPA) to form G6-1B4M dendrimer (9, 10). There were 142–191 1B4M-DTPA moieties per G6-1B4M dendrimer. Cy5.5-*N*-Hydroxysuccinimide ester was reacted with the free primary amines of G6-1B4M to form G6-1B4M-Cy5.5. Finally, G6-1B4M-Cy5.5 was incubated with $Gd(OAc)_3$ in 0.3 M citrate buffer (pH 4.5) for 18 h for Gd complexing with the DTPA moieties in G6-1B4M-Cy5.5. Gd-G6-Cy5.5 was purified with dialysis. Gd-G6-Cy5.5 contained ~172 Gd ions and 2 Cy5.5 molecules per G6 dendrimer.

In Vitro Studies: Testing in Cells and Tissues

[PubMed]

Talanov et al. (10) showed that Gd-G6-Cy5.5 (145 Gd, 1.25 Cy5.5) exhibited T1 and T2 relaxivity values of 13.9 and 36.5 $mmol^{-1}s^{-1}$, respectively.

Animal Studies

Rodents

[PubMed]

Koyama et al. (9) performed MR imaging (3 T) and NIR optical imaging in female nude mice (n = 10) after injection of Gd-G6-Cy5.5 into the left mammary pad. Thirty lymph nodes were examined in each mouse. For MR lymphography studies, a dose of 750 nmol Gd-G6-Cy5.5 was required to consistently visualize at least one SLN in the axillary region in 20–30 min after injection. On the other hand, only 1.2 nmol of Gd-G6-Cy5.5 was required to visualize the axillary SLNs with NIR imaging. When the skin was incised, all SLNs could be easily identified and distinguished from nearby non-SLNs on the basis of their fluorescence. There was a significant correlation (r = 0.86) of fluorescence signal of resected SLNs with MR lymphography measured *in vivo* and *in vitro*.

Other Non-Primate Mammals

[PubMed]

No publication is currently available.

Non-Human Primates

[PubMed]

No publication is currently available.

Human Studies

[PubMed]

No publication is currently available.

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