Nanotechnology Applied to Cancer: Thermal Phototherapy with Gold Nanorods Targeting a Tumoral Biomarker

Poster

Tumor Immunology

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Gold-based nanostructures are promising in cancer therapy due to their ability to induce localized cell death through controlled heating—known as photothermal therapy—when irradiated with light at specific wavelengths, where efficiency depends on shape. Gold nanorods (GNRs), irradiated in the near-infrared (NIR) range, absorb energy and convert it into heat via surface plasmon resonance (SPR), selectively damaging tumor cells. This study applies active targeting to enhance tumor specificity using monoclonal antibodies to guide nanoconjugates toward cells expressing tumor biomarkers. To improve safety and reduce bioaccumulation, GNR surfaces were modified with polyethylene glycol (PEG), which enhances biocompatibility, prevents aggregation, reduces protein corona formation, and limits immune clearance. PEGylation prolongs circulation time and reduces nonspecific interactions. Carboxyl groups in PEG enabled antibody attachment through EDC/NHS coupling chemistry, where PEG-COOH was activated with EDC to form intermediates stabilized by NHS, producing reactive esters that bond covalently with lysine residues of antibodies under mild aqueous conditions. Rituximab (IgG1) was used as a model antibody to

functionalize GNRs before targeting anti-MICA for cells expressing MICA. Conjugation was verified by changes in hydrodynamic diameter (DLS), surface charge (zeta potential), and UV-Vis absorbance shifts. Antibody presence was further confirmed by a dot blot assay. Antibody-functionalized GNRs show potential to improve specificity and efficacy of photothermal cancer therapy. Efficient EDC/NHS conjugation combined with robust validation ensures high-quality nanoconjugates, supporting the development of targeted, less invasive treatments to minimize side effects and improve clinical outcomes.

Palabras Clave

(1) Infrared Laser, (2) Phototermal Phototherapy, (3) Tumor-biomarkers Antibodies, (4) Nanomedicine, (5) Nanorods.

Financiamiento:

National Doctoral Fellowship (2123202), ANILLO Project in Science and/or Technology 2021 (ACT210068), Fondecyt projects (Nos. 1241453 and 1251140).

Agradecimientos:

Supported by the guidance and institutional support of **Dr. Claudia Altamirano** and **Dr. Marcelo J. Kogan** throughout the development of this doctoral research.