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Application of Gold Nanorods in Cancer Photothermaltherapy

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Abstract : Lung cancer is one of the most harmful forms of cancer. The long-term survival rate of lung cancer patients treated by conventional modalities such as surgical resection, radiation, and chemotherapy remains far from satisfactory. Systemic drug delivery is rarely successful because only a limited amount of the chemotherapeutic drug targets lung tumor sites, even when administered at a high dose. Targeted delivery of drug molecules to organs or special sites is one of the most challenging research areas in pharmaceutical sciences. By developing colloidal delivery systems such as liposomes, micelles and nanoparticles a new frontier was opened for improving drug delivery. Nanoparticles with their special characteristics such as small particle size, large surface area and the capability of changing their surface properties have numerous advantages compared with other delivery systems. Targeted nanoparticle delivery to the lungs is an emerging area of interest.Multimodal or combination therapy represents a promising new method to fight disease. Therefore, a combination of different therapeutic strategies may be the best alternative to improve treatment outcomes for lung cancer. Photothermal therapy was proposed as a novel approach to treatment. In this work, photothermal therapy with gold nanoparticles and near infrared laser (NIR) irradiation was investigated.Four types of small (<100nm), NIR absorbing gold nanoparticles (nanospheres, nanorods) were synthesized using wet chemical methods and characterized by transmission electron microscopy, dynamic light scattering and UV-vis spectroscopy. Their synthesis and properties were evaluated, to determine their feasibility as a photothermal agent for clinical applications. In vitro cellular uptake studies of the nanoparticles into lung cancer cell lines was measured using light scattering microscopy.Small gold nanorods had good photothermal properties and the greatest cellular uptake, and were used in photothermal studies. Under 4W laser irradiation, an increase in temperature of 10°C and decrease in cell viability of up to 80% were obtained.

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