Injectable Colloidal Gold for Use in Intrafractional 2D Image-Guided Radiation Therapy - DTU Orbit (13/04/2019)

In the western world, approximately 50% of all cancer patients receive radiotherapy alone or in combination with surgery or chemotherapy. Image-guided radiotherapy (IGRT) has in recent years been introduced to enhance precision of the delivery of radiation dose to tumor tissue. Fiducial markers are often inserted inside the tumor to improve IGRT precision and to enable monitoring of the tumor position during radiation therapy. In the present article, a liquid fiducial tissue marker is presented, which can be injected into tumor tissue using thin and flexible needles. The liquid fiducial has high radio-opacity, which allows for marker-based image guidance in 2D and 3D X-ray imaging during radiation therapy. This is achieved by surface-engineering gold nanoparticles to be highly compatible with a carbohydrate-based gelation matrix. The new fiducial marker is investigated in mice where they are highly biocompatible and stable after implantation. To investigate the clinical potential, a study is conducted in a canine cancer patient with spontaneous developed solid tumor in which the marker is successfully injected and used to align and image-guide radiation treatment of the canine patient. It is concluded that the new fiducial marker has highly interesting properties that warrant investigations in cancer patients.