New nanomedicine delivers improved outcome for prostate cancer

A new nanomedicine, comprised of tiny gold particles coated in a small peptide called RALA, used in combination with radiotherapy, could significantly improve treatment outcomes for men with locally advanced prostate cancer.

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If these nanoparticles are present in tumour cells when treated with radiotherapy, they increase the cell killing potential of this conventional treatment, helping to reduce the risk of disease relapse.

Developed by researchers at Belfast's Queen's University (Queens) the treatment can make cancerous cells up to 30% more receptive to radiotherapy, while simultaneously reducing adverse side effects that limit quality of life.

Prof Helen McCarthy, from the School of Pharmacy at Queen's explains that the peptide enables the gold nanoparticles to be delivered more efficiently to the tumour cells.

"The gold then interacts with the radiotherapy, increasing the cell killing effect in a highly localised manner," she explains.

The gold particles are up to three times more visible on standard medical imaging equipment.

This means that if the nanoparticles are located within the tumour, they should help to improve the accuracy of radiotherapy delivery, reducing the risk of off-target damage to neighbouring normal tissue such as the bladder or bowel.

Combining the gold particles with RALA increases the efficiency of nanoparticle uptake, while also enabling the gold particles to be delivered to regions within the cells which are more sensitive to the effects of radiation damage.

Increasing treatment effectiveness

Radiotherapy is extensively used to treat various localised cancers including prostate cancer, offering the best chance for curative intervention.

However, approximately 30% of prostate cancer patients experience treatment failure leading to disease progression.

Various groups around the world have reported that gold nanoparticles, or other high-atomic number elements, hold the potential to sensitise tumour cells to radiation treatment.

However, a key challenge has been delivering these particles in sufficient levels to the right regions within the tumour cells.

Suppressed tumour sphere growth

The study, published in *Nanobiotechnology*, shows that through the new formulation, prostate cancer cells were rendered up to 30% more sensitive to the cell killing effects of the same radiotherapy used to treat patients.

Furthermore, in experiments investigating the magnitude of effect in small 3D models of prostate tumours called tumour spheres, the combination of radiation and RALA-gold nanoparticles completely suppressed tumour sphere growth.

£376,000 awarded

The multi-disciplinary team were recently awarded £376,000 from Prostate Cancer UK to evaluate the effectiveness of these implants at increasing the sensitivity of prostate cancer cells to radiotherapy.

Dr Jonathan Coulter, from the School of Pharmacy at Queen's say that their research has shown that ultra-low concentrations of the RALA-gold nanoparticles effectively sensitise prostate tumour cells to radiotherapy.

“Now we want to build on this work, to address the second major challenge, consistently delivering sufficient nanoparticles to the tumour throughout a patients’ radiotherapy.

“We are delighted that Prostate Cancer UK are supporting our proposal to develop a biodegradable implant designed to provide sustained release of the gold nanoparticles,” he says.

“Following insertion into the main tumour lesion, the biodegradable implant will consistently release the nanoparticles over time. This is opposed to current approaches that involve daily injections.

“Following consultation with a local prostate cancer patient focus groups, we learned that a one off implant would be better tolerated by patients than regular injections to the tumour,” he adds.