New extra 'sticky' microgel could revolutionise bladder cancer treatment

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Researchers at the University of Reading have designed a new super-efficient way of delivering an anti-cancer drug which could extend and improve the quality of life for bladder cancer patients—and perhaps save lives.

The team developed a unique microgel that is potentially eight times 'stickier' than conventional methods keeping the drug in the bladder for longer. The microgel can also release the drug in a more controlled manner, and for a longer period of time, than alternative delivery methods. This could mean fewer uncomfortable hospital appointments for patients while increasing their chances of recovery.

About 10,000 people are diagnosed with bladder cancer every year in the UK which affects mostly people aged 50 and over. With around 50%[1] of patients succumbing to the disease, bladder cancer is one of the more deadly forms.

However there has been very little progress in bladder cancer therapy since the 1980s. Anti-cancer drugs, such as doxorubicin, are effective but there is an urgent need to make them more efficient. The location of the cancer means that much of the drug is lost through the washout effect with urine. Drugs such as doxorubicin have to be administered into the bladder via a catheter at hospital. Patients are then asked to not to pass urine for at least an hour after drug administration.

This research, funded by the Leverhulme Trust focused on using

materials with -SH chemical groups on their surface. These have a unique ability to stick to mucosal membranes in our body, resisting washout. Professor Vitaliy Khutoryanskiy and his team developed these materials in the form of microgels—swellable particles of sub-micron size—which could be loaded with a chemotherapeutic drug and delivered to the bladder using a catheter.

Small molecules containing -SH groups in protected form were synthesised so they could be converted into particles. The protection of these -SH groups was then removed which resulted in microgels with free -SH groups.

Professor Vitaliy Khutoryanskiy, from the Reading School of Pharmacy, said: "Bladder cancer is a big killer in this country, especially amongst older people. But the development of new therapies has largely been ignored over the last 30 years. It's therefore vital we look at new ways of beating the disease, both through the development of new drugs and making existing drugs more effective. Our microgel has the potential to revolutionise the treatment of bladder cancer.

"This cancer is particularly difficult to treat—a big problem being the poor retention of the drug in the bladder after it's given. Our research demonstrated that doxorubicin can be easily loaded into these microgels and released in a controlled manner for a long period of time, about 24hrs. We also showed that the microgel particles stick to the mucosal lining of a pig bladder and can resist the washout effects with urine. This stickiness means more of the drug stays in the bladder - and for longer.

The next stage in the research will be to test the delivery method 'in vivo' and then hopefully in human trials.

Professor Khutoryanskiy added: "It's early days but this microgel may be a game-changer in the fight against bladder cancer. Patients could live

for longer and in a less stressful manner, with more potentially surviving this terrible disease."

Mr Hugh Mostafid, Consultant Urological Surgeon from Royal Surrey County Hospital, commented: "The current method of intravesical drug delivery has hardly changed since it was first described 50 years ago. Bladder cancer is characterised by frequent recurrences which makes it the most expensive cancer to treat. Professor Khutoryanskiy's work is an exciting and novel development in bladder cancer and opens the way for more effective drug treatments, which in turn would benefit patients through fewer recurrences and longer survival."

More information: "Synthesis of mucoadhesive thiol-bearing microgels from 2-(acetylthio)ethylacrylate and 2-hydroxyethylmethacrylate: novel drug delivery systems for chemotherapeutic agents to the bladder." *J. Mater. Chem. B*, 2015,3, 6599-6604 DOI: 10.1039/C5TB00834D

Provided by University of Reading

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