World-first treatment with 'acoustic cluster therapy' to improve chemotherapy delivery

December 18 2019

Credit: CC0 Public Domain

The first patient has been treated with an innovative new technology that uses microscopic clusters of bubbles and liquid droplets to enhance the delivery of chemotherapy drugs to tumors.

The clusters of microdroplets and microbubbles are injected along with the patient's chemotherapy and the technology, called acoustic cluster therapy, uses a standard ultrasound scan to convert the clusters into an activated form within the tumor.

Once activated, with further ultrasound the clusters help to pump the drug into the tumor, greatly increasing the amount of drug which reaches the cancer cells.

Making chemotherapy more targeted to the tumor

This new treatment, which is now being trialled by The Institute of Cancer Research, London, and The Royal Marsden NHS Foundation Trust, promises to improve the effectiveness of the chemotherapy by better targeting it to the cancer site, and could potentially be explored with reduced doses of drug in order to reduce the severity of side effects.

Acoustic cluster therapy was invented by the Norwegian company Phoenix Solutions. It was further developed with proof-of-concept studies by scientists at The Institute of Cancer Research (ICR) and the Norwegian University of Science and Technology (NTNU), Trondheim.

Early data ahead of larger clinical trials in a curative setting

The phase I/II clinical trial of acoustic cluster therapy will aim to provide early data on the effectiveness of the therapy as well as establish its safety. The treatment will be used to treat patients with tumors in the liver that have spread from the bowel or pancreas.

If the trial is successful, acoustic cluster therapy could enter larger

clinical trials or trials in other cancer types. The researchers aim, eventually, to use acoustic cluster therapy to boost the chemotherapy used to reduce the size of a tumor before surgery—potentially helping to cure some people with cancer.

The clinical trial is largely funded by Phoenix Solutions with additional funding from the Research Council of Norway. It is also supported by the NIHR Biomedical Research Centre at The Royal Marsden and the ICR.

Concentrating more of the drug in the tumor

Professor Jeffrey Bamber, professor in physics applied to medicine, who led the work to further develop and evaluate the technology at The Institute of Cancer Research, London, said:

"We're delighted that our work on innovative acoustic cluster therapy—which is designed to overcome barriers to drug delivery that tumors develop—has progressed to the point where the technology is now being assessed in patients for the first time. It's a very exciting 'door opening' technology which concentrates more of the drug in the tumor.

"We expect eventually to be able to both treat tumors more effectively and reduce the rate and severity of side effects. In the long term we hope this technology will be of particular benefit in difficult-to-treat tumors, such as those of the pancreas. It may also assist new types of treatments such as immunotherapy.

"The joint development and evaluation of this technology is testament to the strength of the ICR's industry collaborations in medical imaging, within an environment where we're able to bring our research discoveries into clinical trials. The trial itself is yet another example of the ICR's strength in working with The Royal Marsden to take research from

'bench to bedside.'"

A much-needed new option for hard-to-treat advanced cancers

Professor Udai Banerji, Deputy Director of Drug Development at The Institute of Cancer Research, London, and The Royal Marsden NHS Foundation Trust, said:

"Our new clinical trial follows on from promising preclinical research that shows this acoustic cluster technology could help to increase the dose of chemotherapy to tumors, potentially allowing a reduced dose to the rest of the body. We're hopeful we can help open up a much-needed new option for patients with hard-to-treat advanced cancers."

"This trial is a real cross-team effort involving radiologists, physicists and nurses who all work together to provide the treatment and support the patient throughout the process."

Reducing side effects to make a difference for patients

Karen Childs from North West London is the first patient to receive this innovative new treatment, as part of a new clinical trial. She is currently being treated at The Royal Marsden for secondary cancer in her liver following her diagnosis in November 2013. Karen said:

"I'm not sure it's sunk in yet that I'm the very first patient in the world to be receiving this new treatment! This trial is an exciting step for the hospital and a huge step for patients like me. It really would make a big difference to patients' lives if side effects could be reduced in the future using more targeted treatments like this. It's an incredible opportunity to

be on this trial and the staff at The Royal Marsden have been amazing and very supportive."

Dr. Per Sontum, chief executive of Phoenix Solutions, which invented the technology, said:

"We are extremely pleased to announce that Phoenix Solutions has initiated the clinical development of Acoustic Cluster Therapy (ACT). After six years of technical work and preclinical development with Professor Jeff Bamber's Ultrasound and Optics Team, our partners at the ICR and The Royal Marsden, the transition to clinical phase is a very exciting moment for all of us, team and collaborators. We look forward to moving to the next phase of the ACTivate study whose goal is to evaluate the clinical benefits of ACT."

Medical physics, imaging and radiotherapy at the ICR and The Royal Marsden

The ICR has a very strong track record in physics applied to medicine, particularly in radiotherapy and imaging. For example, alongside clinicians at our partner hospital, The Royal Marsden, our physics researchers have developed new approaches to imaging such as ultrasound abdominal grayscale imaging, ultrasound speckle noise reduction and elastography, all of which are part of medical scanners today.

They are also international leaders in high intensity focused ultrasound (HIFU) cancer treatment and they pioneered intensity modulated radiotherapy (IMRT) for use in cancer treatment which is a mainstay of cancer treatment today.