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NUS scientists develop painless way to kill breast cancer cells

Senior research fellow Alex Tai (left) and Associate Professor Alfredo Franco-Obregon at a demonstration. The patient receives magnetic pulses from a device through an opening in the bed. PHOTO: NATIONAL UNIVERSITY OF SINGAPORE

They hope their magnetic pulse treatment will reduce the dosage needed for chemotherapy in the future

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Scientists from the National University of Singapore (NUS) have found a painless way to kill breast cancer cells by exposing them to a pulsed magnetic field.

They hope this method will reduce the dosage needed for chemotherapy in the future, so that patients will have fewer side effects.

The treatment uses magnetic pulses to stimulate respiration in the cancer cells, which have elevated levels of a protein, TRPC1, that is especially sensitive to the stimulation. When exposed to the magnetic field, these cells essentially hyperventilate and eventually die.

Pre-clinical trials have shown that the magnetic treatment targets only cancer cells, unlike chemotherapy and radiation therapy, which can also damage healthy cells.

Magnetic fields can also target hidden cancer cells within a tumour that chemotherapy drugs travelling through the bloodstream cannot reach, said Associate Professor Alfredo Franco-Obregon from the NUS Institute for Health Innovation & Technology (iHealthtech), who led the development of the magnetic technology.

When undergoing the magnetic treatment, the patient lies face down on a therapy bed which has an opening for the chest region. The magnetic device – a short, hollow cylinder – is placed below the opening, and generates a pulsed magnetic field.

The team said the strength of the device's magnetic field is about 50 times greater than that of the earth's, but 1,000 times weaker than conventional magnetic resonance imaging (MRI). One treatment session would take an hour.

The NUS research team is planning to start a one-year clinical trial with the National University Cancer Institute, Singapore (NCIS) in the second half of this year, to determine the safety of the device. About 30 breast cancer patients will be involved.

The patients will try out the device for 30 to 60 minutes.

Clinicians will look out for any side effects such as toxicities or skin changes, and track any effects on wound healing after breast surgery, for instance, said Dr Joline Lim, a consultant at NCIS' department of haematology-oncology.

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Number of patients who will be involved in a one-year clinical trial to determine the safety of the device.

30-60 minutes

How long the patients in the clinical trial will try out the magnetic device.

Research on the use of electromagnetism to fight cancer is ongoing globally. An Israel-born company has developed a helmet-like device that sends electric fields to brain cancer cells to disrupt their replication.

Prof Franco-Obregon noted that other existing electromagnetic therapies use a different way of delivering the magnetic fields that also stop healthy and necessary cells from dividing.

For those therapies, the magnetic fields are of a higher frequency and patients need continuous exposure for several hours.

Once the NUS device is deemed safe when used on its own, it will be tested alongside chemotherapy – to further prove that the treatment does not add to the side effects that chemo patients already face.

Should the device clear the safety phase, clinical trials will look at the therapy's effectiveness and efficacy in bolstering breast cancer treatment.

"This is when we want to find out if this machine alongside chemotherapy is really better than just chemotherapy alone," said Dr Lim.

Prof Franco-Obregon said the device did not cause any significant side effects during pre-clinical trials, and a combination of magnetic therapy and chemotherapy was more effective in reducing the size of breast cancer tumours than either treatment by itself.

Breast cancer is the most common cancer among women here, with about six women diagnosed with the disease each day. Dr Lim noted that early detection is becoming more common now with more women getting screening early, through yearly mammograms and monthly self-examinations.

The NUS team is planning to test its magnetic therapy on prostate cancer as well, since the disease shares many similarities with breast cancer.

The breast cancer-fighting device builds on work that Prof Franco-Obregon and his team did a few years ago that targeted the same TRPC1 protein, but for a wholly different reason.

When an elderly patient slid his arm or leg into that earlier magnetic field-generating cylindrical machine, it activated the TRPC1 proteins in the limb, and the muscles responded as if the patient had just exercised, helping to improve muscle functions.

Prof Franco-Obregon said there is growing evidence that exercise releases agents in the body that can reduce cancer growth.

Some day, he hopes patients can use the machine and magnetic therapy together, so that the muscle cells can be an additional weapon against cancer.

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