MCI (P) 091/10/2020

APR/MAY 2022

HEALTHNEWS

INSPIRING AND INFORMATIVE STORIES FOR PATIENTS

THIS MONTH'S INSIGHT:

ADVANCES IN CANCER TREATMENT

CAR T-CELL THERAPY 101

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NEW TECHNOLOGY MAKING A DIFFERENCE IN THE FIGHT AGAINST CANCER

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CAR T-CELL THERAPY 101: LEARN MORE ABOUT THE LATEST TREATMENT AT PCC

A new cancer treatment is making waves for its impressive breakthroughs in the treatment of haematological malignancies. In this issue of HealthNews, we take a look at the basics of CAR T-cell Therapy and how patients will benefit.

What is CAR T-cell Therapy?

Chimeric Antigen Receptor (CAR) T-cell Therapy is a form of immunotherapy where T-cells are taken from the patient's blood and modified in a laboratory setting to enable the T-cells to identify and destroy specific cancer cells. The modified T-cells are then reinfused into the patient.

Once back inside the patient's body, the modified T-cells will be able to detect the cancer cells and destroy the cancer by harnessing the body's own immune response.

Singapore is the first country in Southeast Asia to offer the treatment[1].

What conditions can it treat?

CAR T-cell Therapy is particularly effective for patients diagnosed with relapsed aggressive forms of Acute Lymphoblastic Leukemia (ALL) and relapse of Non-Hodgkin Lymphoma such as Diffuse Large B-cell Lymphoma (DLBCL), especially when at least two prior treatment regimens have failed to produce the desired outcomes.

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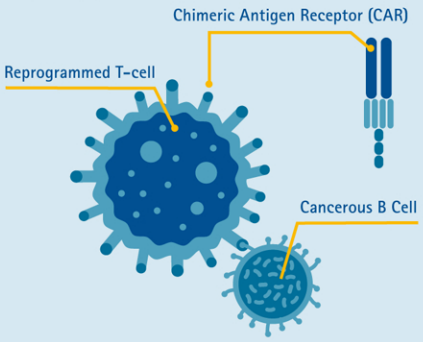
Dr Lee Yuh Shan's area of expertise is in Haematology such as lymphoma, myeloma and haematopoietic stem cells transplant. He is active in undergraduate medical training and is a senior clinical tutor for Yong Loo Lin School of Medicine and Adjunct Associate Professor for Duke NUS School of Medicine. He is also a faculty member of the senior residency program in haematology at Singapore General Hospital (SGH).

[1]*Source: https://www.channelnewsasia.com/singapore/new-therapy-for-leukaemia-among-children-kymriah-blood-cancer-217446*

DID YOU KNOW?

T-cells or T-lymphocytes are a type of white blood cells in our immune system. T-cells have the capacity to recognise abnormal cells or any cells infected by viruses in the body, and then destroy these abnormal cells.

However, T-cells may sometimes fail to recognise or eliminate these threats in the body, such as in the case of cancer.



Who is eligible?

Selected groups of patients are eligible for CAR T-cell Therapy. They include:

- Children and young adult patients from 2–25 years old with B-cell Acute Lymphoblastic Leukemia (ALL) that is resistant, and where a relapse has occurred subsequently or post-transplant.
- Adults with Diffuse Large B-cell Lymphoma (DLBCL) who have not benefited from at least two types of standard treatment.

The following groups of patients may not be eligible for CAR T-Cell Therapy:

- Patients with intracranial hypertension or unconsciousness
- Patients with respiratory failure
- Patients with disseminated intravascular coagulation
- Patients with hematosepsis or uncontrolled active infection

What are the side effects?

One common side effect of CAR T-cell Therapy is Cytokine Release Syndrome (CRS), which is a multisystemic disease resulting from the effects of CAR T-cells at work and elimination of cancer cells.

Side effects of CRS include:

- High fever and chills
- Headaches
- Difficulty breathing
- Fast heartbeat
- Nausea, vomiting and/or diarrhoea
- Fatigue
- Feeling dizzy and lightheaded
- Muscle and/or joint pain

CRS can develop many weeks after infusion, but most commonly develop within two weeks after infusion. The severity of CRS is not correlated with the response to CAR T-cell Therapy.

Another common side effect is immune effector cell-associated neurotoxicity syndrome (ICANS), which affects the central nervous system of the patient.

CRS and ICANS are well recognised side effects that are highly treatable and can be managed by a trained clinical care team.

Is it effective?

CAR T-cell Therapy has shown promising outcomes for the treatment of lymphoma and other blood cancers.

The overall success rate in achieving remission with CAR T-cell Therapy is 60–80% for lymphomas, and 80–90% for leukemias[2]. Many patients with previously relapsed blood tumours have also shown promising results with no evidence of cancer after receiving treatment.

CAR T-cell Therapy offers patients with blood cancers a potential life-saving treatment option in the event that their disease is not controlled by standard chemotherapy, targeted therapy or bone marrow transplantation.

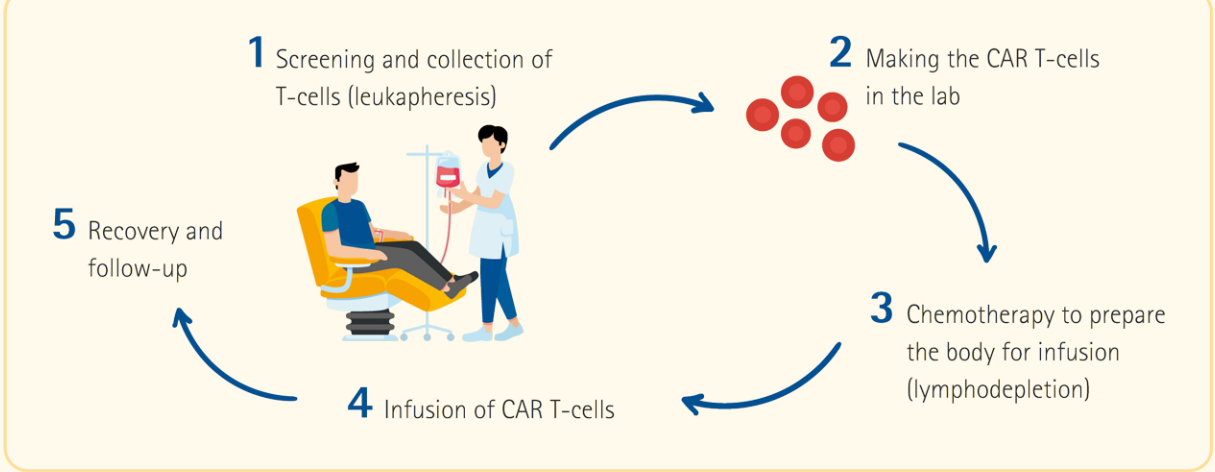
However, as it is a relatively new area of cell therapy, there are some challenges to consider such as the selection of patients who will benefit from this treatment, their level of medical fitness, the timing of cell collection, logistical concerns, and the risk–benefit ratio of treatment for the individual patient. Nevertheless, CAR T-cell Therapy remains a revolutionary therapy with high success rates, and may be an option for non-haematological cancer treatments in the near future. ■

[2]Source: *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7926700/*

CONTINUE READING
Dr Lee Yuh Shan explains how CAR T-cell Therapy works

UNDERSTANDING CAR T-CELL THERAPY: HOW IT WORKS

CAR T-cell Therapy is a cutting-edge treatment that is bringing hope to many patients with Acute Lymphoblastic Leukemia (ALL) and Diffuse Large B-cell Lymphoma (DLBCL). We break down how it works and what the cancer treatment journey looks like for patients receiving treatment.



STEP 1

Screening and collection of T-cells

The patient will first undergo screening and a series of tests to determine if CAR T-cell Therapy is an appropriate treatment option for their disease, and to ensure that the patient is fit to undergo treatment.

White blood cells, which include T-cells, will be extracted from the patient's blood using a procedure called leukapheresis. During this procedure, two intravenous infusion (IV) lines will be inserted into the patient: blood is extracted through one line, to allow the white blood cells to be separated out and extracted, while the rest of the blood is returned to the patient's body through the second line.

Generally, leukapheresis is a safe procedure and will not affect the patient's health. However, patients are advised to get adequate rest with only gentle exercises for 2–3 days after the procedure. Bridging treatment may also be required after the procedure to control the disease while waiting for the CAR T-cells to be infused (in Step 4).

STEP 2

Making the CAR T-cells

When the white blood cells have been extracted, the T-cells will be separated out and sent to the laboratory to be altered. This alteration is carried out by adding the specific Chimeric Antigen Receptor (CAR) gene to the T-cells, hence modifying them into CAR T-cells. These cells will then be grown and multiplied in the laboratory.

Under normal circumstances, it can take 2–3 weeks to produce the adequate number of CAR T-cells required for CAR T-cell Therapy.

STEP 3

Preparing the body for infusion

A short chemotherapy cycle, called lymphodepletion, will be administered a few days before the infusion of CAR T-cells. This is done to lower the number of other immune cells in the body and prepare the body to receive the CAR T-cells.

STEP 4

Infusion of CAR T-cells

When enough CAR T-cells have been produced, the product will be shipped back to the hospital to be infused into the patient.

Once the CAR T-cells begin binding with cancer cells in the body, they will begin to increase in number and destroy even more cancer cells.

STEP 5

Recovery and follow-up

Patients receiving CAR T-cell Therapy will have an early recovery period of approximately 6–8 weeks. During this period, patients will be monitored for any side effects and assessed on treatment response.

Foreign patients will be required to be in Singapore throughout the entire process, which usually takes about 3–4 months from screening to recovery, depending on their individual condition.

CAR T-cell Therapy remains a highly effective treatment that offers improved life expectancy compared to conventional chemotherapy, and brings hope to patients whose diseases have previously failed to respond to most cancer therapies. ■

Scan to discover more about CAR T-cell Therapy

NEW TECHNOLOGY MAKING A DIFFERENCE IN THE FIGHT AGAINST CANCER

Advances in medical technology have led to treatment breakthroughs in the field of radiation oncology. Dr Ivan Tham, Senior Consultant, Radiation Oncology explains some of the new arsenal of treatments available and how patients can benefit from them.

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Dr Ivan Tham has special interest in head and neck cancers, lung cancers and general radiation oncology. He has experience with a variety of treatment techniques. These include stereotactic radiosurgery (SRS), stereotactic body radiotherapy (SBRT) or stereotactic ablative body radiotherapy (SABR), image-guided radiotherapy (IGRT), intensity modulated radiotherapy (IMRT), 3D conformal radiotherapy (3DCRT) and brachytherapy.

1. Intensity Modulated Radiation Therapy (IMRT) & Image Guided Radiation Therapy (IGRT)

Remember the days before smartphones? We were able to call and text, but the functions of a handphone back then was generally limited.

For radiation oncologists, IMRT was the technique that transformed the field and brought it into the 'smartphone' era. While we still use radiation to kill cancer, we can harness newer technologies to deliver treatment plans more effectively with fewer side effects.

In the past, radiation therapy (RT) involved aiming 2–4 beams at the target, and making minor modifications to shield healthy organs or boost the radiation dose to the tumour. However, there were limitations to how treatment can be delivered, especially for large, irregularly shaped targets.

Thanks to the rapid increase in computing power over the past decades, specialised software was developed to perform treatment planning. Rather than manually deciding on the beam directions, we would designate targets in the body and allow the computer algorithms to identify the best possible beam directions and intensities.

This technique, called IMRT, was introduced in 2002 and was used to treat nasopharyngeal cancer. Two decades later, it is now the standard of care for many cancer types.

IGRT adds imaging to RT to improve the accuracy of treatment. With the help of IGRT, a high dose of radiation can be delivered to the target, with a much lower dose just 2–3 mm away. This leaves a very narrow margin of error during treatment.

2. Stereotactic Radiosurgery (SRS) and Stereotactic Body RT (SBRT)

RSRS and SBRT are specialised techniques based on the principles of IMRT/IGRT. They involve large doses of radiation focused on small tumour targets, with treatment completed in only 1–8 treatment sessions.

These techniques can provide good disease control for the brain (SRS) or the rest of the body (SBRT). However, because of the high doses used, not all patients are suitable to receive this treatment. For example, large tumours adjacent to critical structures may require IMRT/IGRT rather than SBRT.

3. Proton Beam Therapy (PBT)

Proton Beam Therapy (PBT) is a form of RT where high-energy protons are used instead of high-energy X-rays. Protons are positively charged particles with special physical properties that allow radiation delivery to be more targeted.

PBT can treat many cancers, and is also often delivered in combination with other treatments such as surgery, chemotherapy, immunotherapy or hormonal therapy.

The potential benefit of PBT over X-ray RT may vary from patient to patient, depending on the tumour location and other disease characteristics. The major advantage of PBT over X-ray RT is that surrounding healthy organs will generally get a lower dose of radiation, and in turn reduce the risk of side effects.

PBT is generally preferred for paediatric cancer patients as they are more sensitive to the long-term effects of radiation. For adults, PBT is mainly used in:

- The treatment of tumours that require high radiation doses for control, e.g. chordoma
- The treatment of tumours that are close to critical structures e.g. brain tumours, prostate cancer, oesophageal cancer, locally advanced head and neck cancers
- Treatment which requires combined chemotherapy and RT, where toxicity can be reduced with the use of PBT

Improvements in technology in recent decades have allowed PBT to become more widely available for clinical use. In Singapore, we will have three operational PBT centres by 2023, including one at Mt Elizabeth Novena Hospital.

4. Flash RT

Flash RT is a new technology where the radiation dose is delivered faster (by about 400 times). In the first clinical case that used flash RT, treatment was completed in 90 ms.

This technology can be applied to X-ray RT, electron RT or PBT.

Cell and animal experiments have shown that quicker radiation delivery can reduce side effects while maintaining effectiveness. One hypothesis is that oxygen is quickly depleted by flash RT, which seems to protect normal tissue from injury, but not tumour cells. Another hypothesis is that flash RT injures fewer circulating white blood cells compared to standard RT, which would help preserve the immune system to fight disease.

While this technology is promising, it is still new. More research needs to be done to see how it can be best implemented for patients.

5. Artificial intelligence (AI) in RT

AI enables computers to perform complex tasks such as visual perception and pattern recognition. This technology helps with problem solving and decision making, with many potential medical applications.

AI allows radiation oncologists to adapt and modify treatment while the patient is in the treatment room. This helps to maintain pinpoint accuracy despite day-to-day variations of the tumour location. Other potential applications include improving image resolution, decision support and prediction of long-term treatment outcomes.

There are many treatment options available nowadays, from new surgical techniques to new immunotherapy drugs and RT techniques. All of them have a role to play—different treatments are required at different points of the patient's journey, so there is no 'one size fits all' strategy. With a multidisciplinary team approach, we can offer a personalised treatment plan that caters to patients' individual care needs and expectations. ■

RESOURCES FOR YOU

Learn how advances in radiation oncology has better managed women's cancer:

Read to discover more about Proton Beam Therapy:

Learn about Stereotactic Body Radiation Therapy (SBRT) vs Conventional Radiotherapy:

A SECOND CHANCE AT LIFE

After Jasmine gave birth to her first child in 2019, the last thing she expected was getting cancer. Fortunately, the young mother managed to overcome many challenges in her fight against the disease and discovered a second chance at life.

Jasmine had just returned back to work after her maternity leave when she started getting breathless from walking up flights of stairs as well as a persistent cough for more than 2 months. She had gone to see her GP but her condition was thought to be related to fatigue from taking care of her newborn.

Despite everyone's concerns, Jasmine went on to go for a babymoon holiday with her husband to Bangkok for a week. The trip was an exhausting one for her, as she had to constantly take breaks in between walking and shopping to catch her breath. When she returned home, her concerned mother insisted she get herself a referral to see a specialist

and an X-ray to make sure that everything was okay.

Her X-ray showed that one lung was white while the other was black. Her specialist referred her to an oncologist for further testing and biopsy, which subsequently confirmed that she had Stage 4 Diffuse Large B-cell Lymphoma.

Dealing with a cancer diagnosis

As a new mother, her first thought upon receiving her diagnosis was her infant daughter.

"My daughter was only 6 months old at the time of diagnosis," recalled Jasmine. "Breastfeeding was put to an abrupt stop, and spending lengths of time in the hospital meant time away from her. I didn't know if I was going to live past this and see her grow up."

Like many cancer patients, Jasmine was also worried about losing her job, not being able to work and not being able to accomplish many things in life, especially as she was still very young.

The biggest challenge for Jasmine was undergoing treatment and dealing with treatment side effects.

"As my immunity was low, I was susceptible to infections and constantly had high fever," Jasmine shared. "My doctors were worried and had me admitted each time I had an infection.

"I also lost all my hair from chemotherapy. At the start, it was hard to accept," Jasmine admitted. "I bought wigs and hats to cover up my head because I honestly hated not having any hair. I was also tired and had no energy to eat or look after my daughter, which saddened me."

"Life can never return back to normal"

Jasmine's life took a 360 degree turn after her initial diagnosis. "Life can never return back to normal when you have gone through cancer," she said. "You'll always be more cautious, and even the people around you will be more worried for you."

However, Jasmine does not see this negatively. "I learned to look after my body a whole lot more and cherish my time with the people I love, and do the things that I love most."

In March 2020, Jasmine finished 6 cycles of chemotherapy treatment and is currently in complete remission. After such a challenging chapter in her life, she is ready to begin the next with a new lease of life.

"I am grateful for my husband who spent sleepless nights worrying and accompanying me to appointments and hospital stays, as well as my parents who made sure I had the best doctors and looked after me and my daughter during this period. I also had a supportive company for letting me go on long medical leave to recover, as well as family and friends who showered me and my family with lots of love during this difficult period.

"I am also grateful to Dr Richard Quek and his team for their expertise and care for me and my family during this journey."

"I am thankful for getting a second chance at life. I now treasure the importance of time and the people around me, and am focused on living life to the fullest." ■

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