How is CAR T-cell therapy different from stem cell transplantation?
Both stem cell transplantation and CAR T-cell therapy are cellular therapies, and many of the steps in the procedures are similar, such as collecting cells from the patient, conditioning chemotherapy, and reinfusion of the cells. However, CAR T-cell therapy and stem cell transplantation differ in many ways. A transplant is not immunotherapy (promoting the body’s own immune response), but rather gives a patient a new immune system to attack the cancer. Patients who receive stem cells from a matched donor may require immunosuppressants to control rejection of the graft or experience graft-versus-host disease. Since the CAR T cells are your own genetically altered cells, your body should not reject these new cells. Additionally, the chemotherapy is less intense, with fewer side effects, and the side effects caused by cytokine release syndrome (CRS) are unique to CAR T-cell therapy.

Is the procedure covered by insurance?
Before undergoing the procedure, ask with your medical insurance provider to see what costs the provider will cover and what costs you will be responsible for paying. If there is a dispute about coverage or if coverage is denied, ask your insurance carrier about their appeals process if a claim is repeatedly denied, contact your state’s insurance agency.

Can I take other medications at the same time as CAR T-cell therapy?
You will need to plan to be near the certified treatment center for at least four weeks after the infusion of your CAR T cells.

How can I be sure that I am getting my own CAR T-cell therapy?
Your T cells are labeled with a unique identifier that stays with them during the entire process, and the identifiers are carefully matched to your identity before the cells are infused.

What symptoms should I call my healthcare provider about or go to the emergency room?
You will need to seek immediate attention for any of the following:
- Signs or symptoms associated with CRS including fever, chills, fatigue, rapid heartbeat, nausea, feeling short of breath, and feeling faint or dizzy upon standing.
- Signs or symptoms associated with neurologic events including altered mental state, sleepiness, memory loss, or personality changes, weakness, changes in your level of consciousness, difficulty writing, speech disorders, tremors, and confusion.
- Signs or symptoms associated with infection such as fever or chills.
- Signs or symptoms associated with bone marrow suppression including feeling very tired, bleeding that does not stop, or feeling faint or dizzy upon standing.

How can I be sure that I am getting my own CAR T-cell therapy?
There are several quality control checks throughout the process to make sure that you only receive your own CAR T cells. Your T cells are matched to your identity before the cells are infused.

How long do I need to be near the certified treatment center?
You will need to plan to be near the certified treatment center for at least four weeks after the infusion of your CAR T cells.

Can I take other medications at the same time as CAR T-cell therapy?
Before receiving the CAR T-cell therapy, tell your healthcare provider about all your medical history, including if you have or have had:
- Lung or breathing conditions
- Kidney conditions
- A recent or active infection

Immunotherapy enhances the power of a patient’s immune system to attack tumors. An immunotherapy approach, called chimeric antigen receptor (CAR) T-cell therapy, uses patients’ own immune cells to treat their cancer.

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CAR T-Cell Transport

The T cells are sent to a processing center where they are genetically enhanced to target your lymphoma.

1. **Leukapheresis**
   - The T cells are sent to a processing center where they are genetically enhanced to target your lymphoma.
   - **T cells**
   - **Blood Cells**
   - **CAR T Cells**

2. **T-Cell Engineering**
   - The genetically enhanced cells now have chimeric antigen receptors (CAR) that allow the T cells to better recognize your cancer cells.
   - **Genetically Engineered T-Cell**

3. **CAR T Infusion**
   - The infusion of CAR T cells takes less than one hour.
   - You may be given acetaminophen (Tylenol) and/or diphenhydramine (Benadryl) before the infusion to prevent or relieve some of the possible side effects.

4. **Chemotherapy**
   - Chemotherapy suppresses the immune system slightly so that it does not react to your CAR T cells.
   - It gives the T cells the chance to grow and fight your lymphoma.

5. **CAR T Cells Attack the Lymphoma**
   - Once the CAR T cells enter your body, they begin to multiply and attack the lymphoma cells.
   - The process continues until the lymphoma cells are gone. Other normal healthy cells in your body can also be attacked and killed by your CAR T cells.

6. **After Receiving the CAR T Cells**
   - After receiving the CAR T cells, you may need to remain in or near the certified treatment center for at least four weeks to be monitored for side effects and treated, if needed.
   - Some patients can receive their CAR T cells as an outpatient with close surveillance in the clinic.

**Side Effects**

- Cytokine Release Syndrome (CRS)

   - CRS usually occurs in the first few days to two weeks after the infusion of the CAR T cells.
   - Side effects will be treated with medications and other supportive treatments in the hospital.

- Neurological Effects

   - Neurological effects may occur between two days and three weeks after receiving the CAR T cells, and usually follow CRS.

**Other Side Effects**

- Hypersensitivity reactions can occur during the infusion.
- Other side effects may include severe or life-threatening infections, reactivation of hepatitis B viral infections, low levels of blood cell counts, and low platelets. As with many other cancer treatments, secondary malignancies are also possible.

**Long-Term Side Effects**

- In most patients, the number of CAR T cells increases to a maximum level within two weeks then steadily declines. However, CAR T-cell therapy is unique in that the genetically modified cells can remain in your body for years, even if all the tumor cells are gone. Other normal healthy cells in your body can also be attacked and killed by CAR T cells.

**Investigational CAR T-Cell Therapies**

- Tisagenlecleucel (Kymriah)
  - Treatment targeting CD19 for patients with certain types of large B-cell lymphoma who have not responded to or who have relapsed (cancer has returned after treatment) after at least two other kinds of treatment.
  - Moderate to severe side effects: Neurological effects, reactivation of hepatitis B viral infections, low levels of blood cell counts, and low platelets.

- Isticabtagene maraleucel (JCAR017)
  - Treatment targeting CD19 for patients with certain types of large B-cell lymphoma who have not responded to or who have relapsed (cancer has returned after treatment) after at least two other kinds of treatment.
  - Moderate to severe side effects: Neurological effects, reactivation of hepatitis B viral infections, low levels of blood cell counts, and low platelets.

**Approved CAR T-Cell Therapies**

- Axicabtagene ciloleucel (Yescarta)
  - Treatment targeting CD20 for patients with certain types of large B-cell lymphoma who have not responded to or who have relapsed (cancer has returned after treatment) after at least two other kinds of treatment.
  - Moderate to severe side effects: Neurological effects, reactivation of hepatitis B viral infections, low levels of blood cell counts, and low platelets.

- Tisagenlecleucel (Kymriah)
  - Treatment targeting CD19 for patients with certain types of large B-cell lymphoma who have not responded to or who have relapsed (cancer has returned after treatment) after at least two other kinds of treatment.
  - Moderate to severe side effects: Neurological effects, reactivation of hepatitis B viral infections, low levels of blood cell counts, and low platelets.

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- Isticabtagene maraleucel (JCAR017)
  - Treatment targeting CD19 for patients with certain types of large B-cell lymphoma who have not responded to or who have relapsed (cancer has returned after treatment) after at least two other kinds of treatment.
  - Moderate to severe side effects: Neurological effects, reactivation of hepatitis B viral infections, low levels of blood cell counts, and low platelets.

**CAR T-Cell Therapies in Lymphoma**

- Allogeneic (donor) CAR T cells
  - Treatment for patients with certain types of large B-cell lymphoma who have not responded to or who have relapsed (cancer has returned after treatment) after at least two other kinds of treatment.
  - Moderate to severe side effects: Neurological effects, reactivation of hepatitis B viral infections, low levels of blood cell counts, and low platelets.

- Adoptive cell therapy
  - Treatment for patients with certain types of large B-cell lymphoma who have not responded to or who have relapsed (cancer has returned after treatment) after at least two other kinds of treatment.
  - Moderate to severe side effects: Neurological effects, reactivation of hepatitis B viral infections, low levels of blood cell counts, and low platelets.

- Innate immune cell therapy
  - Treatment for patients with certain types of large B-cell lymphoma who have not responded to or who have relapsed (cancer has returned after treatment) after at least two other kinds of treatment.
  - Moderate to severe side effects: Neurological effects, reactivation of hepatitis B viral infections, low levels of blood cell counts, and low platelets.

- CAR T-cell therapies that target CD19, CD20, CD22, and CD30 are in development for patients with lymphoma and chronic lymphocytic leukemia (CLL).

- Several CAR T-cell therapies are in clinical trials, including tocilizumab-maronatumab (UCAR-T).