IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

A Review on CAR T-Cell Therapy

Pranjali Kulsange[1], Rajlaxmi Deolekar[2], Smita Jagtap[3]
Students, Final Year[1,2,3]
New Montfort Institute of Pharmacy, Ashti, Wardha, Maharashtra, India
pranjalikulsange0@gmail.com

Abstract: *Chimeric Antigen Receptor (CAR) T-cell therapy is an innovative treatment strategy that involves modifying a patient's T-cells to better recognize and attack cancer cells. This therapy begins with the collection of T-cells from the patient's blood. These cells are then genetically engineered in the laboratory to express a chimeric antigen receptor that specifically targets antigens found on the surface of cancer cells. Once modified, the CAR T-cells are infused back into the patient, where they can proliferate and mount a robust immune response against the cancer. This approach has shown significant success, particularly in hematologic malignancies such as certain types of leukemia and lymphoma. However, CAR T-cell therapy is not without challenges. Patients may experience side effects, including cytokine release syndrome and neurotoxicity. Ongoing research aims to improve the efficacy and safety of this treatment, expand its use to solid tumors, and understand the long-term effects of CAR T-cell therapy.*
In summary, CAR T-cell therapy represents a ground breaking advancement in cancer treatment, harnessing the power of the immune system to fight cancer more effectively.

Keywords: Chimeric Antigen Receptor

I. INTRODUCTION

CAR T-cell therapy, also known as chimeric antigen represents a new treatment that targets malignant cells specifically and induces long-lasting recovery in blood-related tumors that are resistant to treatment, such as numerous myeloma (MM).[1] Numerous clinical trials have shown how promising this therapy is.[2] The primary clinical manifestations of CRS include tachypnoea, tachycardia, fever, hypoxia, hypotension, nausea, and pulmonary edema that results in venous deficiency. These induce circulatory alterations that result in hypovolemia, ischemia, decreased renal flow, and pre-renal AKI.[3] In a comparable manner during the prospective study of Gutgarts et al., 46 Mature individuals including non-Hodgkin cancer (NHL) got Therapy and the CAR T cells treatment & found a total frequency being all degree acute kidney injury being thirty per cent, including categories one-half & Three AKI occurrences being 21.7 percent, &eight percent, correspondingly.[4] Oncology remains a major source for mortality around the world, with There were around 10 million fatalities from cancer in the year 2020 only.[5] Conventional cancer treatments like chemotherapy and radiation treatments may prove productive, nevertheless they can also harm healthy cells leading to serious negative consequences. CAR T-cell therapy, also called chimeric antigen receptor represents two of the more potential treatments for cancer as have come to light in the past few years, when combined with immunology. Chemotherapy known as CAR-T cell treatment is by genetically altering T cells so they generate CARs, that have been able to detect and bind to specific antibodies on the outermost layer of cells with cancer. The Center for Automotive Research is made up of three domains: intracellular signals, membrane-spanning, and extracellular antigen-binding. The intracellular signaling component is triggered following when the CAR-T cell connects the tumor antigens on the tumor cell, causing the T lymphocytes to grow and discharge chemicals that demolish the cancerous cells.[6] Chimeric Antigen Receptors (CARs) are synthetically produced proteins that have been produced on immune cells. It normally consist of a T cells activation domains connected by an HLA-independent (Human Leukocyte Antigen-independent) antigenic recognition site, and they are commonly a single-chain variability fragmentation (scFv) from a particular antibody.[7] And especially medical studies. The costimulatory domains of CAR transporters in the very first, secondly, and third generation have been eliminated, one, and two, respectfully. An additional advantage of more recent generations, such as Protected CARs, lies in the delivery of hormones topically (at the tumor site) or PD1-blocking scFvs, which

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

enhances the CAR T cell's putative activity. Regarding rates of response in B-cell acute lymphoblastic leukemia (B-ALL) as high as 80–90%, CD19-targeted second-generation CAR T cells showed amazing effectiveness.[8-9]

It has proven difficult to duplicate this accomplishment, though, in cases of other cancers, such as CD19-positive tumors other than B-ALL. Allergen Displacement or low T cell endurance were both identified as challenges utilizing currently available CD19-directed CAR T cells, based on analysis of complications among those having treatment with CD19-Directed CAR T cell therapy for B-ALL[10-11] Whenever CARs initially appeared, there was an external scFv& an inside signaling domains that typically incorporated the T-cell receptor's CD3ζ chain, either phosphates the the T-cell & activates it. Whereas the production of cytokines and T-cell activation have been successfully established by the initial-generation CARs, their efficiency and endurance are restricted.[12] Third-generation CARs offer more co-stimulatory messages that can boost the activity of T cells and proliferating, causing more potent therapeutic actions. Fourth-generation CAR-T cells, sometimes referred to as TRUCKs (CAR redirected T-cells that deliver a transgenic product to the targeted tumor tissue), have been created to allow for identifying a wider range of cancerous cells and increase their efficacy in treating various kinds of cancer. In accordance with the subsequent generations CARs, these CARs have a plasmid for the production of cytokines. Upon activation, transport vehicles not only destroy cancer cells however they also release cytokines like IL-12 or IL-18 that attract and stimulate other immune cells while encouraging the elimination of cancer cells, thus augmenting the antitumor response. Because of this, fourth-generation CARs have less side effects than earlier generations and their released cytokines counteract the suppressive substance that malignant cells release for the purpose enable the cells to grow immunoresistant.[13-14] Nevertheless, there continue to be problems that needs to be overcome for the purpose to produce fifth-generation CAR-T therapy. These difficulties involve improving the CARs' design, confirming that they are secure, lessening their adverse effects, & enhancing efficiency in manufacturing. Nevertheless, fifth-generation CAR-T cell procedures constitute a desirable location for investigation in the field of cancer vaccination because of its prospective potential. CAR-T therapy with cells is a multi-step technique that includes development, the infusion may genetic modification, and T-cell harvest . Gathering T-cells from a patient's bloodstream usually the starting point in the whole process. The person receiving treatment has a surgical procedure known as leukapheresis, this is the removal of white blood cells from the human body in order to acquire T-cells. With this, T-cells undergo separation from the other parts of the body, like platelets, white blood plasma, and blood vessel cells. Then utilizing a specialized equipment to restore the blood to the patient's bloodstream.[15]

1.1 History

CAR T Cell Therapy: In 1987, ZeligEshhar, PhD, an immunologists of This Weizmann Institutes of Science in Israel, developed an initial "chimeric antigen receptor," a receptor made from synthetic material which has no counterpart in environment. • In 2010, the laboratory of Stephen Rosenberg, however, M.D., Ph.D., chief of the Surgery Branch in NCI's Center for the Study of Cancer, disclosed the first productive treatment of cancer with CAR-T, which connected insertion of the DNA containing the receptor in T cells to enable them to fight off and eliminate cancer.[16] The Food and Drug Administration (FDA) permitted tisagenlecleucel, formerly referred to as Kymriah, on August 30, 2017, thereby becoming the initially approved CAR T-cell therapy. It was granted permission for children and young adults under the age of 25 that had recently regressed or had trouble recovering.Treatment for ALL, or leukemia with acute lymph During October 2023, the Central Drugs Standard Control Organization (CDSCO) authorized NexCAR19, a CAR-T cell therapies. ImmunoACT, the Indian Institute of Technology Bombay (IIT-B), and Tata Memorial Hospital teamed collaborated on creating NexCAR19.[17] Regions whose the treatment with CAR-T cells is accessible include China, the European Union, Canada, Australia, the United Kingdom, England, and Scotland, among others. • In India:- On June 4, 2021, on the Bone Marrow Transplant unit at ACTREC, Tata Memorial Center in Mumbai, the first CAR-T cell therapy—a form of gene therapy—was performed, making it a momentous day for the TMH, IIT Bombay team, and cancer care in India. In an ancient development for the medical profession in India, Governor Smt.In a ceremony on April 4, DroupadiMurmu unveiled the nation's first indigenously developed chimeric antigen receptor (CAR) T-cell therapy.Actaly-cel is anticipated to cost roughly $50,000, but CAR-T cell treatments can cost up to $400,000 per dose in the US.[18]

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

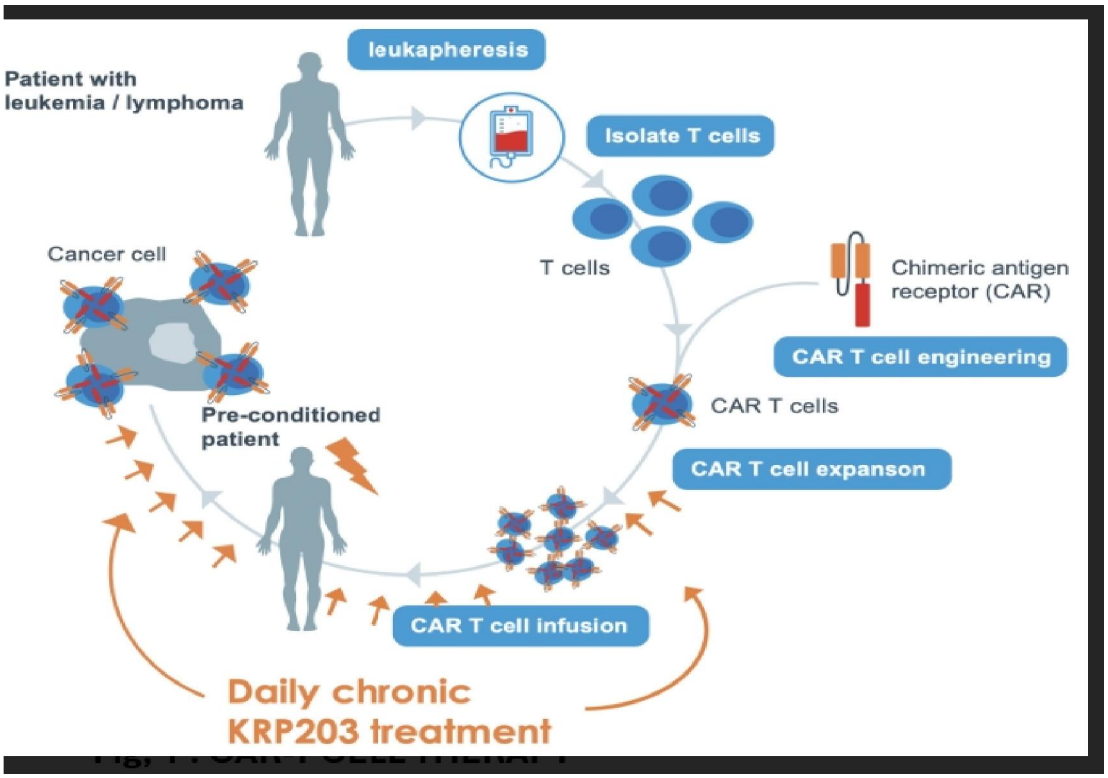

Figure.1

HOW TO WORK BY CAR- T CELL THERAPY?

CAR-T cell therapy is a cancer treatment that involve genetically modifying a patient's T cells to recognise and attack cancer cell .

Step	Description
Collect T cells	A patient's T cells are extracted from their blood using a machine that separates the different components of blood.
Engineer T cells	In a lab, the T cells are modified to have chimeric antigen receptors (CARs) that bind to specific proteins on cancer cells.
Grow CAR T cells	The lab grows millions of CAR T cells.
Infuse CAR T cells	The CAR T cells are injected back into the patient's bloodstream.

Figure. 2

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

CAR T cell therapy is a complex process that's performed by experts . it's designed to be a one-time treatment , and in some cases it has curd people when other treatment have failed . After infusion , the patient are cytokine release syndrome [CRS] and cytokine release syndrome encephalopathy [CRES] Patients are also advised to remain near healthcare facility for at least four weeks after the infusion .

MODELLING AND IT'S IMPORTANCE FOR CAR T CELL THERAPY

Several uses of mathematical structures can be discovered throughout natural and health fields. These mathematical equations use data obtained from experiments to establish or evaluate assumptions and use in vivo projection to calculate numerous most likely consequences. Scenarios constitute among the top methods for examining many kinds of disease-related subjects include such the relationship across antidepressants or biological materials along with complicated immune systems reactions.[19-20] Various approaches to modelling It can be employed to analyse pharmaceutical manufacturing problems, for instance illness improvement, between other things.[21-22] immunotherapy-induced antibodies,[23-24] along with additional.[25-26] The most current Model-Informed The Drug Discovery Phase Initiative makes it easier to create and apply exposure-based, Preclinical studies & medicinal data sources are the beginning for physiological & mathematical theories. It additionally utilizes utilization of a range for Quantification methods for assisting balance the risks and benefits of drug products in development.[27]

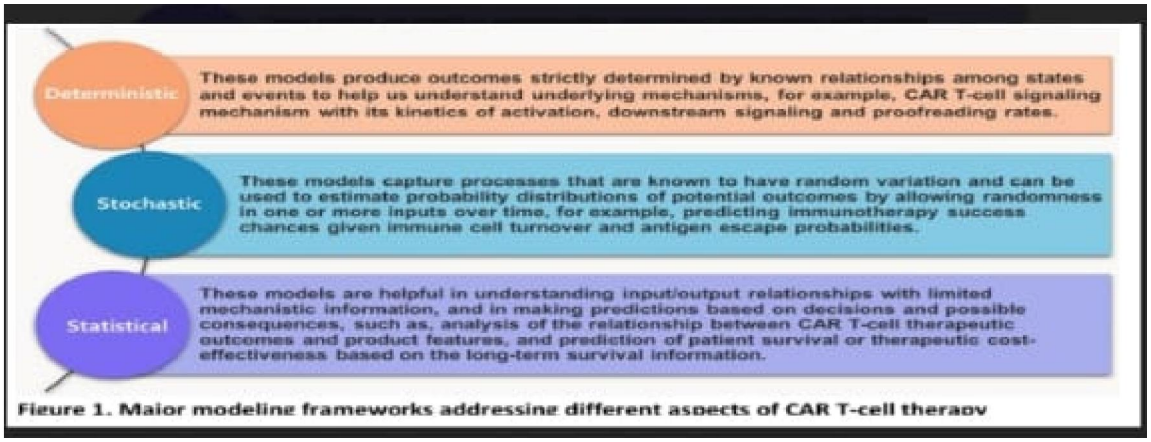

Figure. 3

II. METHODOLOGY

This collection of recommendations for preventative measures was developed by a group of specialists comprising the healthcare facilities that the Spanish Ministry of Healthcare had granted permission to provide CAR T-cell immunotherapy. Management and oversight of ailments. To apply medicinal Conclusions, these recommendations should be regularly regarded Comparing to a fundamental an illness, previous medical care On top of regional ecology. Researching and compiling the work requires pedologists, medical professionals, and professionals in infectious conditions . They conducted an extensive examination of the available literature in Considering the keyword variables "CAR T AND an infection," Medline "CAR T AND prevention," "CAR T AND follow-up," "Hypommaglobulinemia AND CAR T" and "CAR T AND vaccinations. The completed documentation was examined & accepted. By every creator. Table 1 provides an overview of the ones that are most significant suggestions made in this paperwork.

Types of cancer

Brain cancer

One of the more common kinds of primary brain tumors that are malignant is oblastoma (GBM). Currently available options for therapy feature a typical 2-year. That's survival rate that is below thirty percent and typically include surgeries following treatment or therapy.[28] Clinical studies are investigating a range of immunotherapeutic strategies, including intended IL13Ra2, a frequently produced attached to the membrane proteins in more than 75% of GBMs associated with the stimulation of the mammalian target of rapamycin, or mTOR, route favouring growth of tumors as a

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

potential target to feed CAR-T cell treatment in GBM.[29] The human epidermal growth factor receptor 2 (HER2), a receptor for tyrosine kinase which has been overemphasized in GBM and a variety of other human carcinomas, is another significant antigen for CAR T cells.[30]

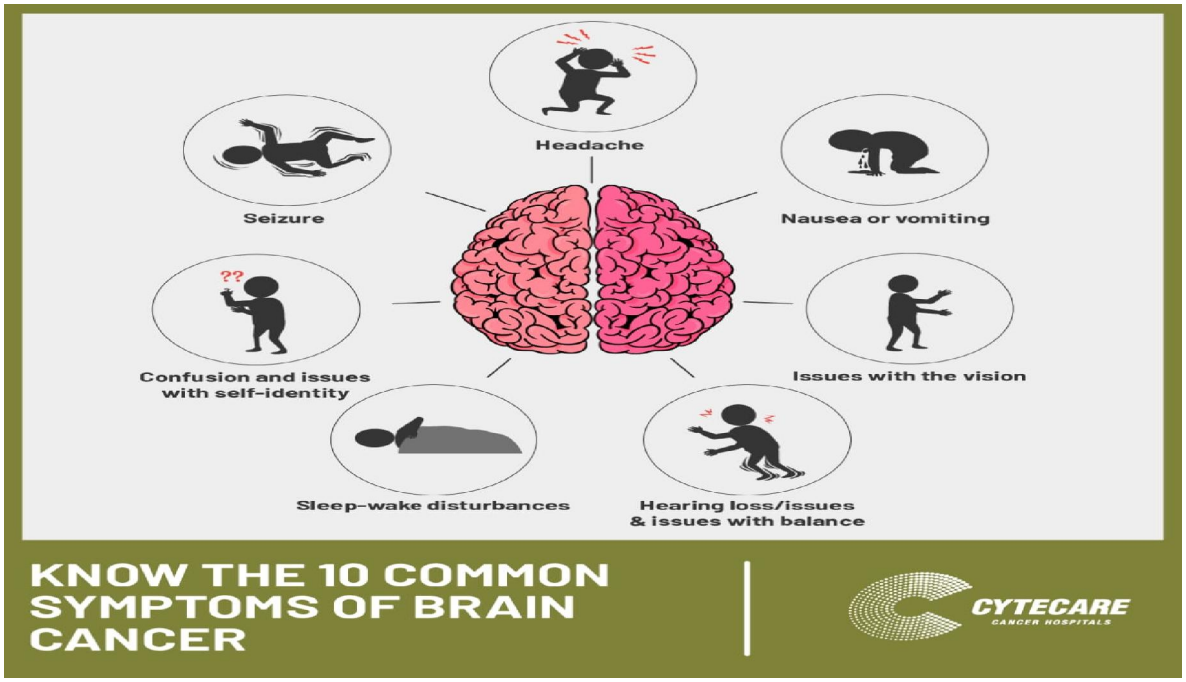

Figure. 5

Pancreas cancer

Though cancer of the pancreas is currently being treated by immunology using antigens which attack PD-1, PDL1, and CTLA-4, CAR T cell therapy is an especially tempting and new therapy approach. Over 90 percent of situations of cancer of the pancreas are caused by a cancer of the pancreatic ducts (PDAC), with an adverse outlook and has a restricted response to conventional therapy. PDAC represents one of the most common types of tumors in the pancreas currently under investigation in clinical studies because of its extremely aggression and possibility of death. Various protein antigens have been identified to be potential possibilities for CAR T cell therapy in pancreatic cancer, following data from clinical and preclinical investigations. Human studies has been provoked, as instance from animal studies on cancer of the pancreas targeted the increased cancer component mesothelin .While mesothelin is found in over 80% of pancreas malignancies and thus serves as an important target for CAR T cell therapy tests, the majority of researchon CAR T cells in patients with PDAC has to do with target mesothelin.[31-32] Targeted objectives includes an achievement of a stable diagnosis, a partial reaction rate, off-tumor effects of HER2, and therapeutic levels of HER2 CAR T cells in vivo in a phase I study of HER2-directed CAR T cells in established pancreatic cancer patients.[33] Initial findings suggest that among the 11 participants accepted, one had higher gastrointestinal signs during an infusion while one had combined transaminitis and a fever before the procedure. Considering the clinical effectiveness, five recipients obtained steady conditions and a single person saw some improvement during more than four months.[35]

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

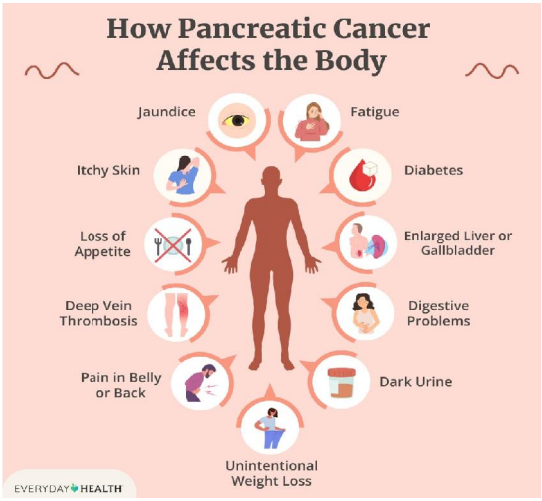

Figure. 6

Breast Cancer:-

As previously reported, MSLN is a strategy identified in many kinds of tumors that are solid and could potentially used as a target for therapy in the treatment of cancer of the breast. While a separate investigation examines the use of HER2-specific CAR T cell therapies for attacking the human version of epidermal growth factor receptor 2 (HER2) in cancers of the breast and other HER2- positive tumors, a phase 1 clinical study is currently underway to evaluate the efficacy and safety of MSLN-specific CAR T cells for those suffering from advanced mesothelin expressing carcinoma of the breast. Finally, it is important to mention another possible goal: the cell-surface enzyme c-Met, which is present at a low level in tissue that is healthy but is produced in 50% of tumors in the breast. Several investigations[35-36] found their Compound is an objective for CAR T cell therapy. Therefore, researchers could begin research studies investigating into the feasibility and security of the target when taking into consideration the possible maximum level of on-target off-tumor harm.

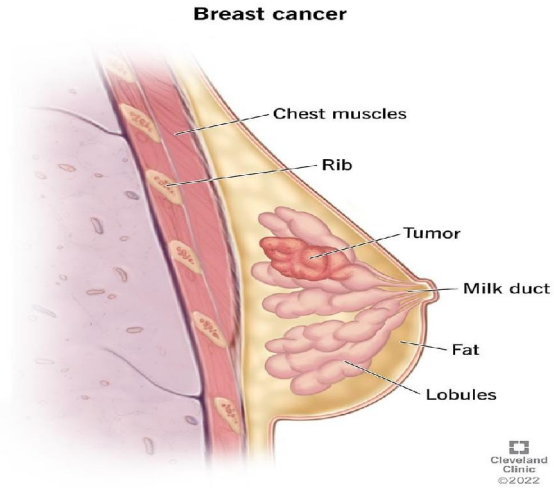

Figure. 7

Ovarian cancer

There hasn't been much study done on CAR T cell treatment for ovarian cancer. Nevertheless, an upcoming early-stage research study was recently published examining the effectiveness of CAR T cells specialized for alpha-folate transporter (FR) for the treatment of malignant ovarian cancer. Though these aren't many known sensory targets for

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

ovarian cancers, FR was examined in this investigation. Patients with FR + ovarian cancer who had been insensitive to platinum/paclitaxel-based therapies were given FR CAR T cells peripherally.[37] The results of the experiment revealed a lack in particular CAR T cell recruitment to the malignant and impairments connected with IL-2 induction, along with no decrease in the weight of the tumor. Additionally, analysis of PCR and radiographs CAR T tagged imagery demonstrated the substantial amount of CAR –Tcells.started to significantly fall two days after the treatment, and a full month later, it had again retreated to undetected levels. Another research study is using direct abdominal implantation of FR+ targeted CAR T cells to increase site identification. It is assessing the viability and safety of this approach with and without lymphodepletion treatment (NCT03585764). Addressing measurable quantities of the Mucin 16 (MUC16) antigen is the focus of a different phase 1 experiment. About 70% of ovarian cancers have a protein like this, and the current study assesses the effectiveness of various CAR T cell concentrations following traditional radiation therapy as well as their impact on tumors.[38]

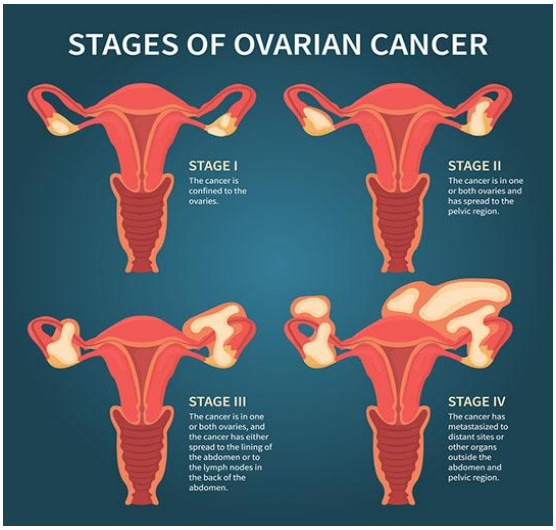

Figure. 8

Benefits of CAR- T cell therapy

Identification of antigen irrespective taking into account HLA; successful with CD4+ and CD8+ T cells; the antigens being targeted consist of polysaccharides, amino acids, and the glycolipids. Simple production of T-cells specific to tumors. Very little chance of GVHD (graft-versus-host disease) or autoimmune. One transfusion of a live medication.Among lymphoid cells are B and T cells. Both kinds are a component of your own defensive system. To combat infections, B cells produce protein known as antibodies. T cells defend you by eliminating dangerous microorganisms and assisting in the regulation of the way your immune system reaction to dangers.[39]

Risk factor

The possibility for transmission may get raised with parameter connected with medical care , the person suffering from the condition in question and the idea of infection,[40,41,42] while maturity was previously linked to a greater chance 0f infection , it has also been identified as a risk factor for CRS and neurological disorder following the use of CAR-T cell therapy[43] the kind and amount of past anti-tumor therapies , together with foundation illness [which is greater in all than in DLBCL] , have all been considered to be potential risk factor for the emergence of disease following therapy can also be influenced by the type and intensity of lymphodepleting chemotherapy , as the amount administered of CAR-T lymphocytes[44] up to 80 percent that people have been reported to suffer from neutrophils in the first month upon implantation.[45]

May additionally increase those who have had continuously prolonged anemia.[46,47,48] Particular illness could get both more probable more than one complicated by CRS syndrome according to the tissue degradation and the therapy it

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

receives with tocilizumab and / or corticosteroid[49,50] person experiencing rheumatoid arthritis , which affect patients use the medication may be extra at risk for disease.

III. CONCLUSION

CAR- T CELL is a new way to treat cancers . It work by taking a persons own immune cells . Changing them in a lab so they can fight cancer and putting then back in the personsbody . This therapy has helped many people , especially those with blood cancers . In terms CAR-T cell therapy is a big step forward in cancer treatment . It gives hope to patients and show that we can use our own immune system to fight cancers . It can also have side effect that need to be managed . Researches are working to make in even better and help more types of cancers .

REFERENCES

[1]. Neelapu SS, Locke FL, Bartlett NL, et al. Axicabtageneciloleucel CAR T-cell therapy in refractory large B-cell lymphoma. N Engl J Med. 2017;377(26):2531–44. https://doi.org/10.1056/NEJMo A1707447

[2]. Klyuchnikov E, Bacher U, Kroll T, et al. Allogeneic hematopoietic Cell transplantation for difuse large B cell lymphoma: who, when and how? Bone Marrow Transplant. 2014;49(1):1–7. https://doi.Org/10.1038/bmt.2013.72

[3]. Ganatra S, Carver JR, Hayek SS, et al. Chimeric antigen receptor T-cell therapy for cancer and heart: JACC council perspectives. J Am CollCardiol. 2019;74(25):3153–63. https://doi.org/10.1016/j.Jacc.2019.10.049.

[4]. Gutgarts V, Jain T, Zheng J, et al. Acute kidney injury after CAR-T Cell therapy: low incidence and rapid recovery. Biol Blood Marrow Transplant. 2020;26(6):1071– 6 https://doi.org/10.1016/j.Bbmt.2020.02.012

[5]. Ferlay J, Colombet M, Soerjomataram I, Parkin DM, Pineros M, Znaor A, et al. Cancer statistics for the year 2020: an overviews. Int J Cancer. 2021. Epub 2021/04/06. https://doi.org/10.1002/ijc.33588. PubMed PMID: 33818764.

[6]. Labneh L, Majzner RG, Mackall CL. Programming CAR-T Cells to kill cancer. Nat Biomed Eng. 2018;2(6):377–91. Epub 2019/04/24. https://doi.org/10.1038/s41551-018-0235-9. PubMed PMID: 31011197.

[7]. Krause A, Guo H-F, Latouche J-B, et al. Antigen-dependent CD28 Signalling selectively enhances survival and proliferation in genetically modified activated human primary T lymphocytes. J Exp Med.1998 Aug 17;188(4):619–626

[8]. Park JH, Riviere I, Gonen M, et al. Long-term follow-up of CD19 CAR Therapy in acute lymphoblastic leukemia. N Engl J Med. 2018 Feb 1;378(5):449–459. Most recent data of the two largest CD19-clinical trial datasets.

[9]. Maude SL, Frey N, Shaw PA, et al. Chimeric antigen receptor T cells for sustained remissions in leukemia. N Engl J Med. 2014 Oct 16;371(16):1507–1517.

[10]. Maude SL, Frey N, Shaw PA, et al. Chimeric antigen receptor T cells for sustained remissions in leukemia. N Engl J Med. 2014 Oct 16;371(16):1507–1517.

[11]. Grupp SA, Maude SL, Shaw P, et al. T cells engineered with A chimeric antigen receptor (CAR) targeting CD19 (CTL019) have Long term persistence and induce durable remissions in children with relapsed, refractory ALL. Am SocHematol. 2014;124(21):380

[12]. James SE, Greenberg PD, Jensen MC, Lin Y, Wang J, Till BG, Et al. Antigen sensitivity of CD22-specifc chimeric TCR is Modulated by target epitope distance from the cell membrane. J Immunol. 2008;180(10):7028–38. Epub 2008/05/06. https://doi.org/10.4049/jimmunol.180.10.7028. PubMed PMID: 18453625; PubMed Central PMCID: PMCPMC2585549.

[13]. Maus MV, June CH. Making better chimeric antigen receptors for adoptive T-cell therapy. Clin Cancer Res. 2016;22(8):187584. Epub 2016/04/17. https://doi.org/10.1158/1078-0432.CCR- 15-1433. PubMed PMID: 27084741; PubMed Central PMCID: PMCPMC4843171.

[14]. Chmielewski M, Abken H. TRUCKs: the fourth generation of CARs. Expert OpinBiolTher. 2015;15(8):1145–54. https://Doi.org/10.1517/14712598.2015.1046430.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

[15]. Schwella N, Braun A, Ahrens N, Rick O, Salama A. Leukapheresis after high-dose chemotherapy and autologous peripheral blood progenitor cell transplantation: a novel approach to Harvest a second autograft. Transfusion. 2003;43(2):259–64. Epub 2003/02/01. https://doi.org/10.1046/j.1537-2995.2003.

[16]. Jackson J, Rafiq S, Brentjens RJ. Driving CAR T-cells forward. Nat Rev Clin Oncol. 2016;13(6):370-383.

[17]. Lee DW, Gardner R, Porter DL, et al. Current concepts in the diagnosis and management of cytokine release syndrome. Blood. 2014;124(2):188- 95.

[18]. JacksonBarrett DM. Current status of chimeric antigen receptor therapy for hematological malignancies. Br J Haematol. 2016;172(1):11-22.

[19]. Hernandez-Vargas EA. Modeling and Control of Infectious Diseases in the Host. 1 ed. 1, Editor2019. 256 p.

[20]. Tomlin CJ, Axelrod JD. Biology by numbers: mathematical modelling in developmental biology. Nat Rev Genet. 2007;8(5):331-40

[21]. Bansal A, Sullivan SD, Lin VW, Purdum AG, Navale L, Cheng P, et al. Estimating Long-Term Survival For Patients with Relapsed or Refractory Large B-Cell Lymphoma Treated with Chimeric Antigen Receptor Therapy: A Comparison of Standard and Mixture Cure Models. Med Decis Making. 2019;39(3):294-8.

[22]. Whittington MD, McQueen RB, Ollendorf DA, Kumar VM, Chapman RH, Tice JA, et al. Long-term Survival and Value of Chimeric Antigen Receptor T-Cell Therapy for Pediatric Patients With Relapsed or Refractory Leukemia. JAMA Pediatr. 2018;172(12):1161-8.

[23]. De Jesus Rodrigues B, Barros LRC, Almeida RC. Three-Compartment Model of CAR T-cell Immunotherapy. bioRxiv. 2019:779793.

[24]. Talkington A, Dantoin C, Durrett R. Ordinary Differential Equation Models for Adoptive Immunotherapy. Bull Math Biol. 2018;80(5):1059-83

[25]. Hanson S, Grimes DR, Taylor-King JP, Bauer B, Warman PI, Frankenstein Z, et al. Toxicity Management in CAR T cell therapy for B-ALL: Mathematical modelling as a new avenue for improvement. BioRxiv. 2016:049908

[26]. Toor AA, Chesney A, Zweit J, Reed J, Hashmi SK. A dynamical systems perspective on chimeric Antigen receptor T-cell dosing. Bone Marrow Transplant. 2019;54(3):485-9.

[27]. Madabushi R, Benjamin JM, Grewal R, Pacanowski MA, Strauss DG, Wang Y, et al. The US Food And Drug Administration's model-informed drug development paired meeting pilot program: early Experience and impact. Clinical Pharmacology & Therapeutics. 2019;106(1):74-8.

[28]. Ostrom QT, Gittleman H, Truitt G, Boscia A, Kruchko C, BarnholtzSloan JS. CBTRUS statistical report: primary brain and other central Nervous system tumors diagnosed in the United States in 2011–2015.Neuro Oncol. 2018;20(suppl_4):iv1-iv86.

[29]. Thaci B, Brown CE, Binello E, Werbaneth K, Sampath P, SenguptaS.Significance of interleukin-13 receptor alpha 2-targeted glioblastoma Therapy. Neuro Oncol. 2014;16(10):1304-12.

[30]. Zhang C, Burger MC, Jennewein L, Genssler S, Schonfeld K, Zeiner P, Et al. ErbB2/HER2-Specific NK Cells for Targeted Therapy of Glioblastoma. J Natl Cancer Inst. 2016;108(5).

[31]. Argani P, Iacobuzio-Donahue C, Ryu B, Rosty C, Goggins M, Wilentz RE, et al. Mesothelin is overexpressed in the vast majority of ductalAdenocarcinomas of the pancreas: identification of a new pancreatic Cancer marker by serial analysis of gene expression (SAGE). Clin Cancer Res. 2001;7(12):3862-8.

[32]. Morello A, Sadelain M, Adusumilli PS. Mesothelin-Targeted CARs: Driving T Cells to Solid Tumors. Cancer Discov. 2016;6(2):133-46.

[33]. Feng K, Liu Y, Guo Y, Qiu J, Wu Z, Dai H, et al. Phase I study of Chimeric antigen receptor modified T cells in treating HER2-positive Advanced biliary tract cancers and pancreatic cancers. Protein Cell. 2018;9(10):838-47.

[34]. Feng K, Liu Y, Guo Y, Qiu J, Wu Z, Dai H, et al. Phase I study of Chimeric antigen receptor modified T cells in treating HER2-positiveAdvanced biliary tract cancers and pancreatic cancers. Protein Cell.2018;9(10):838-47

[35]. Ghoussoub RA, Dillon DA, D'Aquila T, Rimm EB, Fearon ER, Rimm DL.Expression of c-met is a strong independent prognostic factor in breast Carcinoma. Cancer. 1998;82(8):1513-20.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

[36]. Tchou J, Zhao Y, Levine BL, Zhang PJ, Davis MM, Melenhorst JJ, et al. Safety and Efficacy of Intratumoral Injections of Chimeric Antigen Receptor (CAR) T Cells in Metastatic Breast Cancer. Cancer Immunol Res. 2017;5(12):1152-61.

[37]. Kershaw MH, Westwood JA, Parker LL, Wang G, Eshhar Z,Mavroukakis SA, et al. A phase I study on adoptive immunotherapy using gene-modified T cells for ovarian cancer. Clin Cancer Res.2006;12(20 Pt 1):6106-15.

[38]. Aithal A, Rauth S, Kshirsagar P, Shah A, Lakshmanan I, Junker WM,Et al. MUC16 as a novel target for cancer therapy. Expert OpinTherTargets. 2018;22(8):675-86.

[39]. Maude SL, Teachey DT, Porter DL, Grupp SA. CD19-targeted chimeric antigen receptor T-cell therapy for acute lymphoblastic leukemia. Blood. 2015;125(26):4017-4023.

[40]. Park JH, Romero FA, Taur Y, Sadelain M, Brentjens RJ, Hohl TM, et al. Cytokine release syndrome grade as a predictive Marker for infections in patients with relapsed or refractory B-cell acute lymphoblastic leukemia treated with chimeric antigen receptor T cells. Clin Infect Dis. 2018;67:533–40.

[41]. Wudhikarn K, Palomba ML, Paninis M, Garcia-Recio M, Flynn JR, Devlin SM, et al. Infection during the first year in patients Treated with CD19 CAR T cells for difuse large B cell lymphoma. Blood Cancer J. 2020;10:79.

[42]. Hill JA, Li D, Hay KA, Green ML, Cherian S, Chen X, Et al. Infectious complications of CD19-targeted chimeric Antigen receptor-modified T-cell immunotherapy. Blood. 2018;131:121–30

[43]. Pasquini MC, Locke FL, Herrera AF, Siddiqi T, Ghobadi A, Komanduri KV, et al. Post-marketing use outcomes of an antiCD19 chimeric antigen receptor (CAR) T cell therapy, axicabtageneciloleucel (Axi-Cel), for the treatment of large B cell lymphoma (LBCL) in the United States (US). Blood. 2019;134:764.

[44]. Hill JA, Li D, Hay KA, Green ML, Cherian S, Chen X, Et al. Infectious complications of CD19-targeted chimeric Antigen receptor-modified T-cell immunotherapy. Blood. 2018;131:121–30.

[45]. Yescarta EMA product information [Internet]. [cited 2020 Feb 12]. https://www.ema.europa.eu/en/documents/product-inforMation/yescarta-epar-product-information_en.pdf. Accessed Feb 2020.

[46]. Cordeiro A, Bezerra ED, Hirayama AV, Hill JA, Wu QV, Voutsinas J, et al. Late events after treatment with CD19-targeted Chimeric antigen receptor modifed T cells. Biol Blood Marrow Transplant. 2020;26:26–33.

[47]. Yescarta EMA product information [Internet]. [cited 2020 Feb 12]. https://www.ema.europa.eu/en/documents/product-inforMation/yescarta-epar-product-information_en.pdf. Accessed Feb 2020.

[48]. Maude SL, Laetsch TW, Buechner J, Rives S, Boyer M, Bittencourt H, et al. Tisagenlecleucel in children and young adults with B-cell lymphoblastic leukemia. N Engl J Med. 2018;378:439–48

[49]. Yescarta EMA product information [Internet]. [cited 2020 Feb 12]. https://www.ema.europa.eu/en/documents/product-inforMation/yescarta-epar-product-information_en.pdf. Accessed Feb 2020

[50]. Hill JA, Li D, Hay KA, Green ML, Cherian S, Chen X, Et al. Infectious complications of CD19-targeted chimeric Antigen receptor-modified T-cell immunotherapy. Blood. 2018;131:121–30

[51]. Schif MH, Kremer JM, Jahreis A, Vernon E, Isaacs JD, van Vollenhoven RF. Integrated safety in tocilizumab clinical trials. Arthritis Res Ther. 2011;13:R141