Modern cancer; integrating treatments and technology

Introduction

Cancer is a disease in which some of the body's cells grow uncontrollably and spread to other parts of the body. Cancer is the second highest cause of death worldwide.In the past 20 years, many research studies have focused on finding new therapies.Cancer drug discovery and treatments have undergone extraordinary changes .The understanding of cancer has advanced considerably and treatments are less punishing. Modern cancer treatment is characterized by integrating advancing technology, drug discovery and treatments. This paper highlights a few innovations in cancer treatments over the past few years that have helped improve the quality of lives of patients and increase mortality ratios. Over the years ,doctors and scientists have tried to modify and innovate on treatments based on past mistakes or gaps in already existing treatments such as surgery,radiation and chemotherapy.One of the largest unmet needs in modern cancer is the identification of new drug targets and therapies for cancer .Cancer research and treatments take years to be used with patients officially and the future of oncology will require clinical trials and combining treatments to maximize the benefits of both into one therapy, such as oncolytic viral therapy and CAR-T cell therapy, which I discussed in this paper . Throughout this paper I have covered how cancer treatment has evolved in the past 50 years,and highlighted the benefits, limitations and intersections of a selection of treatments: Oncolytic viral therapy, Personalized cancer medicine, Proton beam therapy ,and Car T cell therapy.The conclusion proposes how modern cancer treatments have impacted lives and where the future of oncology lies in the coming years for better patient outcomes .

New and improved times

The new and improved times during cancer treatment is the transition from treatments that were used in the past to how they were modified according to the patients needs and to resolve the limitations to create modern treatments.
As a list of cancer treatments and targets continues to grow we must develop improved methods for their recognition and validation.This section of the research paper focuses on the new and improved times in cancer treatments that are pushing along existing lines of attack,opening entirely new lines of attack and coordinating the treatments along multiple lines of attack.Scientists and doctors are learning from their mistakes and side effects in previous forms of treatment and are trying to come up with innovative approaches of treating the disease.

Oncolytic viral therapy

Oncolytic viruses are a form of immunotherapy that uses viruses to infect and destroy cancer cells.

Oncolytic viruses offer a real benefit for treatment because you can inject an individual tumor and you do not need to define a primary antigen that is present in that tumor. Immunotherapy is an evolving and promising cancer treatment, works by stimulating the immune system.The treatments can fuel the body's production of cancer-fighting cells or help healthy cells identify and attack cancer cells.The oncolytic virus will induce a very strong immune response largely built on the immune system's response to the viral components but there will be viruses spreading to tumor antigens and so it continues to be very exciting as an adjunct to immunotherapy. In the early days of development of oncolytic viruses, the scientists were looking for that direct killing by the virus of the tumor cells but we now understand that it probably is immune response so that you can see rejection of un-injected lesions which is an episcopal effect (2),as the future of oncolytic viruses remains in involving combination therapies.So, in situations where the T cells are not present at the tumor are the types of cancers that are not amenable to immunotherapy right now . Since nothing can get a T cell response better than a virus,the idea here is to use a virus to turn these T cell poor tumors into T cell rich environments and then add additional immunotherapy. This treatment may be very promising in the future as the technology advances.

Personalized cancer medicine

Personalized medicine is a form of medicine that uses information about a person's own genes or proteins to prevent, diagnose, or treat disease. In cancer, personalized medicine uses specific information about a person's tumor to help make a diagnosis, plan treatment, find out how well treatment is working, or make a prognosis. (3)These have made us think and reflect on a difference and as analysts plan more compelling medications. They have moreover utilized hereditary data to create tests for cancer and ways to avoid it. Personalized cancer therapeutics can have less side effects than other sorts of treatment. This is often since it is planned to be more particular.

The goal of personalized medicine is to use the right drug at the right dose, with minimal or no toxicity, for the right patient at the right time.[4] A personalized treatment may influence healthy cells less and cancerous cells more. Cancer moreover has been observed to occur in people who have no family history of cancer. Precision medicine is a way health care providers can offer and plan specific care for their patients, based on the person's genes (or the genes in their cancer cells).Development of genomics and proteomics in cancer offers the possibility of molecular diagnostics in the levels of gene and protein.

Why Personalized Medicine Is Needed

Despite the fact that DNA from different cells is the same, genes that code for one organ (and its cells) behave differently from genes in other organs. Different cancer tumors may have the same DNA, but gene expression is different for different tumor types. Technologies such as gene-expression microarray allow us to examine the gene expression profile of hundreds of genes at a time and to distinguish a cancer-associated gene expression profile from normal profiling.A world where personalization is the norm and where each cancer patient can be treated specifically based on his or her choice. A world where each cancer patient can be given a cancer treatment with no off target toxicities and with high effectiveness and fighting off the foreignness in the body that is the cancer.

What is the difference between precision medicine and personalized medicine and why is it important?

There's an important difference:

Precision medicine involves a more refined targeting to individuals who have a high likelihood of benefiting from a specific therapy or is almost certain to benefit

from a specific therapy. So for example, estrogen receptor expression identifies patients who benefit from endocrine therapy.
HER2 expression identifies patients who benefit from HER2 therapy. But not all patients benefit from those therapies and the development of new tools. New tests can more precisely refine who will benefit from those therapies and in addition, identify mechanisms of resistance to those therapies so that we can add additional therapies to overcome that resistance.
So for example, we know that many cancers that we detect very early on, such as insight to carcinoma the breast or also very early stage of breast cancers would never have been detected if we didn't do mammography or PSA screening, and many of those patients would have lived long lives and never had the cancer diagnosed, and it would never have been a cause of their death.

Limitations of precision medicine

It is widely known that the presence of more than one molecular change collectively with tumor heterogeneity continually limits the usage of monotherapy, that can justify the dearth of advantage derived from a precision method.

Despite a promising organic historical past justifying precision remedy, positive poor effects have highlighted obstacles withinside the molecularly pushed remedy strategy. There was a SHIVA trial in which 741 cancer patients recognized with any form of strong tumor had been screened for molecular changes and randomized to acquire the health practitioner in charge`s remedy of desire as opposed to focused remedy decided on in line with their molecular profile should function a paradigm for what continues to be incompletely understood while making use of for precision remedy in most cancers sufferers. This No advantage in median survival rate became found in molecularly oriented sufferers as opposed to traditional method suggesting that off-label use of molecularly focused marketers does now no longer enhance progression-free survival in comparison with general remedy.Nevertheless, important evaluation can display positive obstacles probably answerable for the failure of this method .Moreover, factors of the method used on this trial are questionable, which includes hormonal remedy in closely handled sufferers or nonspecific inhibitors while focused on positive molecular changes .

In this case, the presence of closely pretreated populations and concomitant molecular changes should justify the dearth of advantage. Moreover, numerous discordant effects had been acquired by the usage of decided objectives in strong tumors sharing the equal molecular changes.

Proton beam therapy -

Proton therapy is a form of radiation treatment used to destroy tumor cells. Instead of using x-rays like regular radiation treatment, it uses protons to send beams of high energy that can target tumors more precisely than X-ray radiation. Proton beam therapy is often used in pediatric oncology as it reduces the risk of long term brain damage in children and reduces the side effects that radiation usually tends to have .
Children with malignancies of the central nervous system (brain and spinal cord) and the eye, such as retinoblastoma and orbital rhabdomyosarcoma, may get proton treatment. (Dinesh Mayani, D. Proton Therapy for Cancer Treatment. *J. Oncol. Pharm. Pract.* 2011)
Proton therapy has several advantages over the traditional radiation therapy, including radiation injury to healthy tissues is less likely.
Some forms of tumours may be able to receive a greater radiation dose, which may prevent the tumour from growing or spreading.
Long-term consequences associated with traditional radiation therapy may be reduced, with fewer and less severe side effects (such as low blood counts and fatigue).
Over the last few decades, pediatric oncology treatment has improved dramatically, and 5-year overall survival is currently about 80%. In the United States alone, there are roughly 270,000 childhood cancer survivors.

Long-term consequences include growth abnormalities, second malignancies, neurologic complications, reduced IQ, cardiac and pulmonary toxicities, and infertility may all be reduced with the use of proton therapy. Up to two-third of the patients will develop long-term toxicity, some of which will be fatal are more likely to occur in pediatric cancer patients

Combination therapy

Car t cell therapy is a type of treatment in which a patient's T cells (a type of immune system cell) are modified in the laboratory so they will attack cancer cells. T cells are taken from a patient’s blood,then the gene for a special receptor that binds to a certain protein on the patient’s cancer cells is added to the T cells in the laboratory and can kill many cancer cells at once.

The combination therapy using oncolytic viral therapy and CAR -T cell therapy is effective because oncolytic therapy has the ability to specifically target cells and replicate in them ,which is unusual. One of nature's most destructive pathogens are viruses and we are using that to target cancer rather than using it to cause a disease. “CAR” T-cell therapy involves re-engineering the immune system to see a cancer, and

we are able to engineer T-cells to be specific to any target that we are interested in." The first effective example of that was liquid cancer targeting a protein called CD-19 .There is no such thing as CD-19 for a solid tumor they are heterogeneous. They have a mosaic of proteins expressed inside the cell and outside the cell and it makes it challenging to identify one protein there in compasses the entire one of the major challenges for developing car T-cell therapy for solid tumors . Another challenge is the immunosuppressive tumor microenvironment which are the physical barriers that are presented by solid tumors that prevent adequate t -cell infiltration so the idea that we had was using oncolytic virus as a vehicle to deliver a target of interest , these were picked out from chimeric viruses that re-engineered virus to express CD19 with the idea if it infects the tumor cells specifically then the CD 19 and so it will deliver a CD 19 which will produce a protein shuttle to the surface and it can be targeted by the most effective car T-cell therapy we are aware of today which is CD-19 and the advantage of combination therapy it's not just a single layer of therapy or treatment against multiple layers it's not just the cortisol is it is not in the situation that may not have been infected by the virus it's the combination of both that recruits the endogenous immune system to the tumor to target the cells that may not have been targeted by the virus. The initiation of clinical trials and the exciting part of the development process is that in the future we may be able to use this or variation of this for any patient with cancer. Whether the patient has breast cancer, ovarian cancer, pancreatic cancer , colon cancer or any other type of "solid tumor," this type of therapy could be used.

CAR-T cells are revolutionizing the field of cancer therapy, providing hope for a cure in patients with previously refractory cancers (2–8). However, despite the stunning results of CAR-T cells in patients with hematologic malignancies, this approach has shown little effect in patients with solid tumors. Recent clinical trials demonstrated that CAR-T cells are able to infiltrate the tumor mass and exert antigen-directed activity

table

Cancer Therapy	Advantages	Limitations
Oncolytic viral therapy	Oncolytic viral therapy aids in the tumor **The ability to generate virions rapidly and genetically engineer additional genes that promote antitumor immunity, increase tumor cell susceptibility to ionizing radiation**	**chills, fatigue, flu-like symptoms, injection site pain, nausea, and fever**. **relatively poor intratumoral penetration** by the oncolytic viruses,

Personalized medicine	High specificity • Reduction of adverse reactions	Lack of information regarding long-term side effects
Proton beam therapy		Reduces the likelihood of secondary tumors caused by the treatment .
Combination therapy of oncolytic viral therapy and CAR T cell therapy		

. So we are now just beginning to develop tools to identify which of those cancers will become a problem so that we can direct our therapies to the ones that really need to be detected early on so the treatment plan is most effective.

Conclusions and outlook

Over the past few years ,modern cancer treatments have impacted saving lives in a tremendous way .Treatments that have been covered in the paper such as oncolytic viral therapy ,proton beam therapy have been less invasive and more precise in targeting the tumor even if it has metastasised to other parts of the body . Precision medicine also does makeup a huge part of major innovating cancer treatments because doctors and scientists had learnt from their mistakes and went back to look at what was affected negatively and hence focus on the specific areas to improvise on it so that we can maximize the lifespan of cancer patients.Combinations of highly targeted agents can be put together in a logical manner based on detailed genetic manner ,treatments such as oncolytic viral therapy and car T cell therapy are highly specific and engineered .I think the future will hold it when you'll walk into a doctor's office with this, the patient will walk in with a memory stick that will have their electronic medical information and will have genetic information about their tumor and about themselves about their DNA makeup that will allow us to more rationally develop a treatment plan than we do now. So obviously creating extraordinary possibilities in terms of access and potentially quick diagnosis and targeted diagnosis and treatment, but also privacy issues.

What happens if you lose that can be a problem. And so that's why it'll be important on the informatics side to figure out ways to encrypt this to be password protected so that you know, an individual's privacy can be protected.
Cancer care in the next decade will be more personalized, with more personalized tests and medicines available. Patients will be genetically profiled, with genetic mutations identified and treated accordingly.Whereas we do need further research and development to effectively treat cancer we have come a long way in terms of integrating ideas and innovation to save lives .

1) Oncolytic Virus Therapy
https://www.cancerresearch.org/en-us/immunotherapy/treatment-types/oncolytic-virus-therapy/.

2.) Formenti, Silvia C, and Sandra Demaria. “Radiation therapy to convert the tumor into an in situ vaccine.” International journal of radiation oncology, biology, physics vol. 84,4 (2012): 879-80. doi:10.1016/j.ijrobp.2012.06.020

3)https://www.cancer.gov/publications/dictionaries/cancer-terms/def/personalized-medicine

4)Verma, M. V. (2012, January 30). Personalized Medicine and Cancer

5)Paulina Krzyszczyk, Alison Acevedo, Erika J

6) Gambardella, V.; Tarazona, N.; Cejalvo, J. M.; Lombardi, P.; Huerta, M.; Roselló, S.; Fleitas, T.; Roda, D.; Cervantes, A. Personalized Medicine: Recent Progress in Cancer Therapy. Cancers 2020, 12 (4). https://doi.org/10.3390/cancers12041009.

7)Mittal, N., & Kent, P. (2017). Long-Term Survivors of Childhood Cancer: The Late Effects of Therapy. In K. Wonders, & B. Stout (Eds.), Pediatric Cancer Survivors. IntechOpen. https://doi.org/10.5772/67366

8)Nguyen, Q. N., Ly, N. B., Komaki, R., Levy, L. B., Gomez, D. R., Chang, J. Y., Allen, P. K., Mehran, R. J., Lu, C., Gillin, M., Liao, Z., & Cox, J. D. (2015). Long-term outcomes after proton therapy, with concurrent chemotherapy, for stage II-III inoperable non-small cell lung cancer. Radiotherapy and oncology : journal of the European Society for Therapeutic Radiology and Oncology, 115(3), 367–372. https://doi.org/10.1016/j.radonc.2015.05.014

9) NCI Dictionary of Cancer terms.
https://www.cancer.gov/publications/dictionaries/cancer-terms/def/car-t-cell-therapy (accessed Apr 29, 2022).

10) Https://Libguides.Williams.Edu/Citing/Acs#s-Lg-Box-19398839. Retrieved February 4, 2022, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4251363/pdf/jpm-02-00001.pdf

https://doi.org/10.1177/1078155210375858.