**The importance of our microbiome and utilization of immune cells in cancer treatment and prevention**

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**Cancer is a highly progressive disease and has been treated with a multitude arrangement of treatments, from chemotherapy to immunotherapy. Within the realm of cancer treatment lies the highly progressive and innovative use of immunotherapy. This type of biological therapy can aid in the reduction of damage done during the treatment as well as utilize our own immune system and microbiota. When there is a dysbiosis within our microbiome, our body becomes suspectable to diseases and illness because microorganisms within are beneficial in their respective amounts. In these studies, conducted by researchers, the body’s own immune defenses are highly used and provide beneficial results in the treatment of cancer with the aid of microorganisms and other cancer treatments. This information relays the importance of maintaining homeostasis within our own microbiota to prevent disruption of our immune system and prevent the accumulation of diseases. But also bringing light to the contribution our own immune cells have on treatments for cancer and utilizing those treatments to give strength back to our immune system to combat cancerous cells.**

**Introduction**

For ages cancer has been studied upon, and still is today. Cancer is a genetic disease of which the body’s cells rapidly grow and replicate uncontrollably signaling the activation of the oncogenes which are presently known as cancerous genes. This accumulates within a certain area forming tumors and then is transmitted across different parts of the body, through a process called metastasis. These cells differ from normal cells as they replicate without any type of signals and avoid apoptosis. These cells also can disrupt and disguise within our body, fooling our immune cells to protect the tumors, or are muted, unable to function normally due to the molecules released by the tumors to preserve the growth. This disease is the 2nd main cause of mortality within the world today and is one of the hardest diseases to be treated due to its unpredictable nature. When looking for treatment our body’s’ main defense system is our immune system. Our immune system is responsible for maintaining the well-being of our health. To have strong immunity we must have a strong immune system but for every person that may not be the case, our bodies microbiome is a large contributor as to how we are able to defend and recover from infections and diseases.

Our inner microbiota is essentially the living organisms within our body consisting of bacteria, fungi, and other microorganisms that cohabitant within, providing essential nutrients, sustainability, and defense systems. The body grows through different stages in acquiring bacteria to further benefit our growth and health but can also be the cause of most of our illnesses and diseases if not taken care of. Our immune system benefits greatly from our microbiome, and vice versa. The immune system is a community of cells and organs dedicated to healing and defending against foreign antibodies that may cause us harm. These immune cells and organs are consisted of adaptive and innate immune cells, organs such as our spleen, bone marrow and much more. Our immune system creates antibodies that operate to protect us from infections, especially reinfections. The working of all our immune cells in conjunction of all their specific functions are what maintain our immunity and overall wellbeing.
Cancer is a multifaceted disease that requires the cooperation of our immune system and specified treatments to help boost the functions of our immune cells to prevent further growth and spreading of cancerous cells. Although treatment is key, our own microbiome will come into play when working with a specified treatment called immunotherapy.
 Immunotherapy is a treatment specialized in aiding our immune system in fighting the diseases and utilizes living organisms in conjunction in treating cancer. The type of immunotherapy treatments that are currently researched and used are immune check point inhibitors, T-cell transfer therapy, treatment vaccines and much more [6]. The one that is specifically used within the one of the research articles used for this analysis is immune checkpoint inhibitors. This type of treatment is the use of drugs that are used to block immune checkpoints that are normally used within our immune system [2]. These check points are important because they monitor our immune responses and prevent overuse of immune responses as too strong of immune responses can lead to devastating results. With the use of these ICI drugs, the immune cells can be focused on the cancer cells, tumors, more efficiently and not to the specified checkpoints due to the blocking. This allows our T-cells, which are responsible for destroying foreign infections within our body, to attack and destroy the cancerous cells. Immune therapy treatments are used in a wide variety of cancer treatments and can be used in conjunction with other cancer treatments such as radiotherapy and chemotherapy. Studies used for the review of the role of microbiome status and its effects on effectiveness of immunotherapy and other types of treatments is analyzed through various studies identifying the success of a treatment based on poor and strong gut health, as well as the consequences of each on the relations to cancer.

**Recent Progress**

In recent years, the study of immunotherapy and our own microbiome has been a topic of interest. In recent articles concerning the use of immunotherapy in cancer treatments as well as the role of our own microbiome has on the outcome of the treatment including even the accumulation of cancer is studied and articulated. For the article “Effect of Prior Antibiotic or Chemotherapy Treatment on Immunotherapy Response in Non-Small Cell Lung Cancer” the scientists articulate the association of the gut microbiome on the responsiveness of the immunotherapy treatments with the usages of antibiotics and chemotherapy. Although the responsiveness with these factors were not direct correlations to their respective outcomes, they paved a platform for further investigation. Their analysis of the results of their investigation on the results of the treatments on patients with NSMCLC with just immunotherapy, specifically ICI, then combination with chemotherapy, and one with antibiotics were taken into consideration. The results were that patients who had exposure to chemotherapy and antibiotics negatively impacted the ICI treatment as opposed to those who did not when comparing survival rate and therapy response. This result was led to a conclusion that due to the alteration of the gut microbiome from the antibiotics and chemotherapy, the successfulness of the ICI treatment was not as effective [4].
The next partnering research done in correlation to prior study was the “Dysbiosis of the Gut Microbiome is associated with Tumor Biomarkers in Lung Cancer” which scientists began a research into the association of dysbiosis of our microbiome and tumor biomarkers via fecal samples. The scientists’ accessed this data with patients with lung cancer and dispersed them into groups based on their positive biomarkers such as CYFRA21-1 (10), NSE (9), and CEA (11) [1]. To keep the integrity of the research done the patients had no prior treatment for their cancer. They did however contain s disease, illness, or some type of use of probiotics/antibiotics. After the patients were assed the scientists were able to gather a control group to compare results who had not used of antibiotics and probiotics before admitted. The collection of fecal matter was taken from all groups and the microbial DNA were extracted and processed based on 16s rRNA readings. After the data was acquired, they performed statistical analysis and procured a statistically significance in comparison of groups. The results consisted of the analysis of the multitude of microorganisms that are, in relation to our metabolic processes and immunity, accounted for within the samples and the predominate genera of microbes were most abundant within the gut biome. The variety and distribution of the microbiota within the lung cancer groups were significantly decreased compared to the healthy group, specifically the *Firmicutes and Bacteroidetes.* The bacteria that were abundant in the healthy group are associated with healthy fatty acids that were greater in number within this group, this is known to be associated with processes that create healthy cell division and immunity but in lung cancer patients it is resulted that these groups had a decreased amounts of these bacteria’s but instead had a greater amount of *Proteobacteria and Verrucomicrobia*. The dispersion of the amounts of different types of bacteria within both groups were shown to give note to the fact that dysbiosis of the microbiota was shown to be present in those with diseases, specifically lung cancer, and prove the importance of maintaining the natural flora to prevent the disruption of dysregulation of our basic metabolic and immunological processes that are contributors to the metastasis of cancer [1].

**Discussion**

The study of immunotherapy is partnered with the introspection of our own microbiome. The utilization of our microbiome can prove to be beneficial in treating cancer, specifically using it to amplify the different types of immunotherapy treatments. The microorganisms that help facilitate and provide use with vital nutrients can also be a benefactor for our own immunity, with this knowledge further studies on altering and using microorganisms to stimulate and aid the responses of our immune system could provide positive and effective results in treating cancer. The dysbiosis of our microbiome has been proven to lead to diseases and impact our overall health and immunity. Knowing this, it sheds the importance of correcting it and perhaps even preventing the occurrences of diseases such as cancer, although it is not an absolute prevention it could certainly help in strengthening our own immunity and overall ability to combat the diseases. Learning about our own microbiome and using it as a tool to enhance immunity, as well as anti-tumor immunity can enhance our ability to treat cancer through combinations of therapies along with immunotherapy [7].

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