

Investigation and Identification of the causes and effects of Cancer - a Basic Overview

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ABSTRACT

This paper discusses the depths of cancer and its impact on society as of the calendar year 2023. The paper goes into detail on the specific treatments preferred by patients such as chemotherapy, radiation-therapy, and surgery. It provides an overview of the difficulty concerned with curing cancer and compares cancer with other major diseases of the recent past. This paper also goes through some of the major preventative steps that could possibly help with avoiding the disease of cancer in an individual's lifetime. Overall, through the accumulation of treatments, background information such as causes and effects, and preventative steps this article illustrates the complexity of cancer and provides a basic understanding of what cancer is and how to potentially avoid it.

Introduction

Just in the calendar year of 2022, over 1.9 million new cases of cancer have been identified, over 600,000 cases of which resulted in fatalities [1]. These cases belong to only the United States, as global effects are catastrophic. Throughout history the world has encountered numerous deadly diseases such as influenza, the black plague, and coronavirus. To differentiate these diseases from cancer, they have reliable treatments while cancer does not. For cancer, despite the efforts of treatments such as radiation therapy, active surgery, and chemotherapy a profound treatment to cure cancer has not been discovered. To put into perspective the complexity in curing cancer, diseases such as the black plague don't only have antibodies to cure the disease but also have preventative steps such as keeping a clean environment. The issue with cancer involves the reality that neither a profound treatment has been developed nor are there any proven steps to prevent cancer. 1 in 5 deaths in the USA are due to cancer, while 1 in 3 people are expected to have cancer in their lifetime [2]. While lung, prostate, stomach and liver cancers are the most common among men. Breast, colorectal, cervical, lung and thyroid are common among women [3]. Cancer itself is a large group of diseases with the ability to start anywhere in the human body. Cancer begins when abnormal cells grow uncontrollably beyond their jurisdiction and start invading nearby tissues and organs. This process is called "metastasizing" and is one of the major causes for deaths related to cancer. Cancer cells themselves develop when healthy genes undergo multiple changes in a period of time. An example of a series of changes that could possibly cause cancer include a cocktail of lifestyle habits such as smoking, misfortunate genetic inheritance, and cancer causing agents in the environment such as certain pesticides. There are 5 stages in which cancer runs its course through. Stage 0: carcinoma in situ, which is when a cancer cell is first identified. Stage 1: localized, when the cancer has spread to nearby tissues. Stage 2 and 3: Early and Late locally advanced, which are when the cancers grow deeply into nearby tissues. Lastly Stage 4: Metastasized, which is when the cancer spreads from where it started to relatively distant parts of the body [5]. Cancer is a difficult disease to cure, although the treatments that are still available, are proven to be somewhat effective.

Cancer

Cancer is a disease in which an abnormal cell in the body grows uncontrollably and spreads to other parts of the body. Cancer can start almost anywhere in the human body, which is made up of trillions of cells. In a healthy human body, cells grow and multiply (through a process called cell division) to form new cells as the body needs them [7]. When cells grow old or become damaged, they die, and new cells take their place. The human body has fought cancer hundreds of times without the host even knowing it. When cells are divided there are always corrupted cells, although when reviewed by the T-cells of the immune system they are erased. Over time one corrupted cell would be left unchecked, that one cancer encrypted cell would multiply itself making it stronger and adding onto itself. These cells may form tumors, which are lumps of tissue. These lumps of tissue slowly corrupt the organs in its way, turning them “cancerous”. Tumors can be cancerous or not cancerous (benign). Cancerous tumors spread into, or invade, nearby tissues and can travel to distant places in the body to form new tumors which in other words is a term called metastasis. Cancerous tumors may also be called malignant tumors. Many cancers form solid tumors, but cancers of the blood, such as leukemias, generally do not. Benign tumors do not spread into, or invade, nearby tissues. When removed, benign tumors usually don’t grow back, whereas cancerous tumors sometimes do. Benign tumors can sometimes be big, although are usually not an issue. The symptoms of cancer are pretty straight forward, they include unexplained weight loss, chronic tiredness, persistent pain, fever (mainly at night), and finally skin changes (particularly changes in moles). These are only symptoms of early stages of cancer, although later symptoms include bruising or bleeding more easily, lumps or bumps under skin, difficulty breathing, and difficulty swallowing. Clearly, early identification of Cancer increases the risks of curing the cancer as not only the symptoms are less severe but the tumor itself would be less advanced. Cancer is usually most common in the elderly although people from all ages have been proven to be affected by cancer. Surprisingly only 1 percent of cancer cases have been diagnosed in people under the age of 20, although that one percent itself accounts for 19,000 patients in just the United States! 18.8% of cancer patients have been proven to be between 20-54 years old, and the rest being over 55 years old [8]. Although cancer affects the elderly most of all, clearly people of all ages could be at risk of cancer. Scientists believe there is no single cause for cancer, but at the same time they believe it is the interaction of many factors together that produces cancer. The factors involved may be genetic, environmental, or constitutional characteristics of the individual. Cancer diagnosis and cancers don’t affect everybody the same way and vary from person to person making cancer more of a threat. Also, the versatility of cancer makes it such a hard disease to cure. The endless symptoms and varieties in which cancer presents itself makes it nearly impossible to identify a cure to. It is evidently extremely difficult to find a way to effectively and continuously cure cancer, although there are many treatments in which cancer could be cured.

Treatments

There are many treatments out there for cancer but the most effective include surgery, chemotherapy, radiational therapy, immunotherapy, or even combinations of these. The first of these prominent methods of treating cancer includes surgery. There are 2 types of surgery, open surgery and minimally invasive surgery. Although one method is more preferred than the other, both prove to be extremely successful. In open surgery, the surgeon makes one large incision and completely removes the tumor, while in minimally invasive surgery the surgeon makes several small incisions rather than one large one. After the surgeon makes these incisions, they insert a long thin tube with a small camera attached to it. The camera projects real time images from the inside of the body onto a nearby monitor. This allows the surgeon to actively focus on what they are doing, allowing them to be more accurate with removing the tumor. After this process is complete, surgeons then use special surgical tools that are inserted into the tube to remove the tumor [10]. Even though both surgeries are proven to work, minimally invasive surgery surpasses open surgery in various ways. In general minimally invasive surgery is linked to less pain, a shorter hospital stay and fewer complications [11]. Next is chemotherapy, this treatment

works by stopping or slowing cancer cells, which divide and grow at alarming rates. Chemotherapy is generally used for two reasons, to treat cancer and to ease cancer symptoms. Chemotherapy like surgery is also used to treat a handful of cancers proving itself useful.

Although chemotherapy is useful and effective it is not the best way to cure cancer. Chemotherapy can be quite expensive, but most of all chemotherapy has major side effects. While slowing the cancer cells chemotherapy can also slow down the growth of healthy cells imposing a major threat [12]. Third, Radiation therapy is a cancer treatment that uses high doses of radiation to kill cancer cells or shrink tumors. Radiation itself is nothing new to doctors as it is used at very small doses as x-rays to see inside your body. These x-rays can identify bones from the teeth formation to broken bones. There are two primary types of radiation therapy, the first includes the external beam radiation therapy. This therapy comes from a large noisy machine that aims radiation at your cancer to kill the cancer cell. The treatment itself does not affect the patient very much as it has no sensory aspects to it other than its sound. Although at high quantities of radiation the body could be moved around. The external beam radiation therapy is a local treatment meaning it only treats a specific part of your body. For example if you had cancer in your lungs, the radiation would only be directed to your chest. The second prominent type of radiation therapy is Internal radiation therapy. Internal radiation therapy is a treatment where a source of radiation is inserted inside of the body. The radiation source can be both solid and liquid and it basically goes where the cancer is. Radiation therapy itself is used to treat multiple cancers, although some of the most common include cancers affecting the head and neck, breast, cervix, and even the eye [13]. Lastly, immunotherapy is another type of treatment that helps the immune system fight off cancer. Immunotherapy is a biological treatment in which substances made from living organisms are used to fight against cancer. Like mentioned earlier, in a healthy immune system, the system detects and destroys abnormal cells. Cells called immune cells are sometimes found around tumors. These cells, called tumor-infiltrating lymphocytes (TILs), are a sign that the immune system is correctly identifying the tumor. People whose tumors have TILs often respond better than people whose tumors don't contain them[14]. There are many types of immunotherapy, although the two most prevalent forms include T-cell transfer therapy and monoclonal antibodies. T-cell transfer therapy is a therapy in which the immune cells of a tumor are removed and altered with attributes to fight against the tumor more effectively. When the cells are altered (in a lab) it is also grown in large batches so that when reunited with the tumor, it could be taken down with speed and efficiency. Monoclonal antibodies, which are also lab-grown proteins aiding the immune system, serve as another form of immunotherapy. These cells are designed to bind to specific targets on cancer cells taking them out of the equation. In other cases the cells could also mark a specific spot on the tumor so that the immune system could take note of the spot and destroy it. Immunotherapy has been approved to treat many types of cancer although it is not yet used as much as other treatments such as surgery, radiation therapy, and chemotherapy. The side effects of immunotherapy are similar to side effects in both radiation and chemotherapies. Immunotherapy also has the effect of affecting healthy cells along with the cancer cells. Although when viewed upon into the grand scheme of things, the benefits outweigh the risks proving that immunotherapy also falls under the category of effective cancer treatments. Though all of these treatments have been proven to work, certain cancers are harder to treat than others. For instance, some cancers have very low success rates. Cancers affecting the pancreas, liver and lung fall into this category. At the same time some cancers also have a very high rate of survival. These cancers include early diagnosed breast cancer, acute lymphatic leukemia in children, and testis cancer. In between these two categories there are also cancers that have a good long-term survival rate, these cancers are prostate cancer, and advanced lymphoma [14].

Prevention

There are many ways to avoid and possibly prevent the deadly disease of cancer. Here are 6 different ways that are proven to help against cancer. The first way to prevent cancer includes maintaining a healthy weight. Maintaining a healthy weight is crucial in many ways. For starters, Overweight and obesity can cause changes in the body such as long-lasting inflammation and higher than normal levels of insulin. When the insulin level is increased, it could lead to alters in growth factors and the sex hormones. As mentioned earlier, changes to these factors are huge contributors to cancer. The risk of cancer increases with the more excess weight a person gains and the longer a person is overweight [15]. Next, physical activity can help regulate some hormones that contribute to the development of cancer and help keep the immune system healthy. Regular exercise also helps you stay healthy, which helps regulate hormones and helps the immune system [16]. The webpage also suggests that an estimated 14 to 20 percent of cancer patients who had passed away were also overweight or obese. Third, do not smoke or use tobacco. The CDC believes that smoking can cause cancer and block your body from fighting it. Cigarettes contain poisons that can weaken the immune system, making it harder for your body to resist cancer cells. When these cancer cells aren't resisted they keep growing without being stopped. Poisons in tobacco smoke can damage or change a cell's DNA [17]. Yet again when the DNA is damaged cancer is caused. Next, eating fruits and vegetables has long been known to provide many health benefits. The organization goes on to state how fruits and vegetables contain vitamins, minerals, and antioxidants that may help decrease the risk of cancer in particular areas of the digestive system [18]. Eating healthy foods such as raw proteins and antioxidants have generationally proven to be helpful to the health of the body. There is no difference with cancer, consuming the right foods and limiting the wrong ones will definitely bring the body the right ingredients to prevent diseases even as big as cancer. Fifth, limit alcohol will be acceptable although complete avoidance of alcohol is always best. When alcohol is consumed, the body breaks it down into a chemical called acetaldehyde. Acetaldehyde damages the DNA and prevents the body from repairing the damage done [19]. Just like the other causes when DNA is damaged, cancer is formed. Finally, the final preventative step to take to possibly prevent cancer is to protect yourself from the sun and avoid tanning beds. The sun emits UV radiation which is very bad for the skin. More importantly for people with less melanin (skin protection from UV radiation) this can cause skin cancer and other infections. It is very important to get annual screening tests as recommended by doctors, as these tests can allow doctors to identify early stages of cancer. The earlier cancer is identified the higher the chances of curing it. To summarize, keep the body's immune system and DNA strong to prevent cancer as these are some of the leading causes of cancer. Figure 4: Condensed Chart

Conclusion

Cancer, an enduring presence in our world, has cast a profound shadow for many years, claiming the lives of millions of people every single year. As present multiple times earlier in this discourse, the profound challenge in conquering cancer lies in its remarkable adaptability and the numerous transformations it can undergo. The quest for a definitive cure has been an extremely difficult journey, fraught with complexities. The ever-evolving nature of cancer poses an extremely difficult hurdle, making the identification of a straightforward cure an elusive goal. In the face of these unfortunate circumstances, cancer persists as a daunting threat, relentlessly taking out the lives of millions of people each year. The absence of a definitive cure adds a layer of somber reality to the persistent struggle against this deadly disease. Although despite the seemingly overwhelming odds stacked against humanity in the battle against cancer, the beacon of hope remains undiminished. It is very important to harbor a sense of optimism, a belief that, at some juncture, we will unravel the mysteries of this disease and finally solve the problem. The current landscape, when viewed through the lens of the last few decades, reveals significant strides in our collective efforts to combat cancer. Promisingly, treatments such as radiation therapy, surgical interventions, and chemotherapy have emerged as potent weapons in our arsenal against cancer. These therapeutic modalities have demonstrated efficacy in mitigating the impact of the disease and, in some cases, even achieving remission. The battlefield may be vast, and the war protracted, but with each

passing day, our understanding deepens, and our hope is getting restored. The road ahead may be long, winding, and filled with challenges, but the collective human spirit must persevere. With hope as our beacon of hope, we will need to navigate through the uncertainties, steadfast in the belief that a conclusive victory against cancer is not just a distant aspiration but an achievable reality in the near future. The trajectory of progress witnessed in recent years instills confidence that, as a united front, we will triumph over this treacherous disease, rewriting the narrative of cancer once and for all.

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