

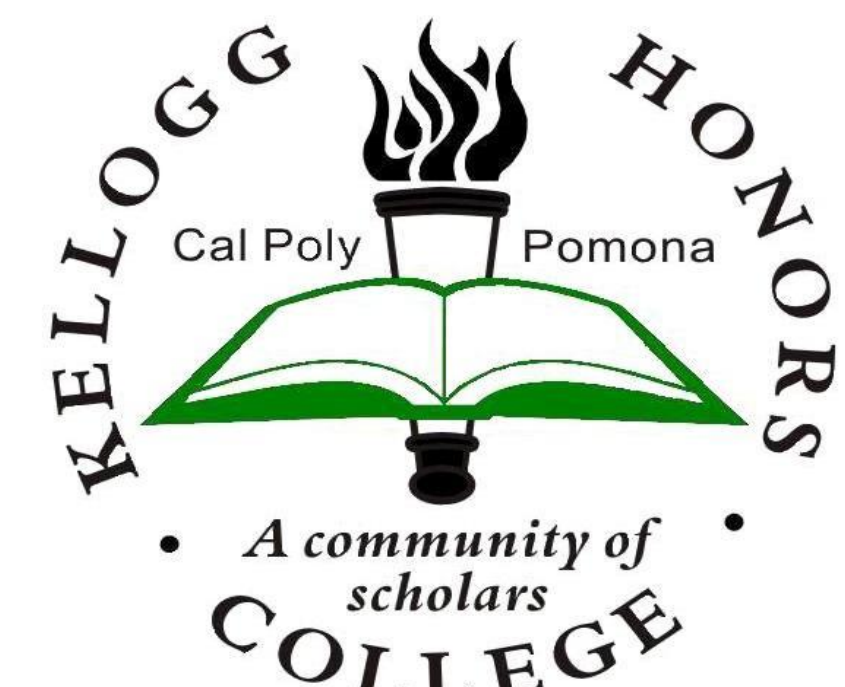
The Effects of Chemotherapy on the Immune System



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Abstract

Chemotherapy is a treatment in which cytotoxic drugs aim to cease the regeneration of cancer cells. Chemotherapy drugs are engineered to weaken tumor cells and as a result the body's immune system has a better chance of eliminating the deadly cancer cells. Although chemotherapy may be practiced on individuals with different diseases, it is commonly used on cancer patients. Chemotherapy medication does not only affect cancer, but it affects the immune system as well. The immune system has two branches called the innate and the adaptive. The innate immune system is the first line of defense to respond with cells and proteins to attack abnormal substances entering the body. Its goal is to slow down the progression of tumor-cells. The adaptive immune system responds only after foreign substances invade the innate immune system. Chemotherapy drugs are engineered to target fast growing cells. These types of cells not only include cancer cells, but cells in the bone marrow, mouth, intestinal tract, nose, nails, and hair as well. When chemotherapy affects the bone marrow, the count of red blood cells, white blood cells, and platelets is reduced. The lack of white blood cells caused the body's defense system to be weak and therefore more prone to infection. Patients undergoing chemotherapy treatments also tend to fatigue rapidly and lose appetite. Therefore, adequate rest and a good nutrition plan are important. As mentioned earlier, white blood cell count will go down due to the medication. It is vital that doctors monitor the complete blood count in order to take proper measures if the patient blood count becomes abnormally low. An important white blood cell to take into account is the neutrophils. This white blood cell's job is to engulf bacteria, germs, and fungi. The normal ranges are from 2,500-6,000 to prevent the patient from risk of infection. Although chemotherapy has various effects on the body there are several measures both the doctor and patient can take meanwhile the treatment. For example, able patients may engage in exercise to reap some benefits. First of all, it may reduce fatigue in cancer patients. Secondly, it can also help improve muscle strength, joint flexibility, and conditioning. These are all fitness areas that may be affected by some chemotherapy treatments. In addition to the physiological benefits, exercise may also improve mood in cancer patients. This would provide good relief if patients experience some depression during their treatment.

Chemotherapy and the Immune System

Other than genetics, tumors can develop if the immune system is not able to stop it. The chances of tumors developing increase if elements of the immune system are missing. The immune system is made up of two branches called the innate and the adaptive system. The innate immune system functions in tumor rejection and immune surveillance. As the front line of defense, the innate immune system contains natural killer cells and NTK cells that aid in either eliminating foreign material or eliminating tumor cells. The innate immune system has the potential to destroy cancer cells if enough antigens are present. The second branch of the immune system is the adaptive. This branch has one of the most prominent anti-tumor cell called the CD8+ CTL. This cell is known to suppress cancer cells and when a lot of this cell is present, it can help in the regression of some cancers like melanoma lesions.

although immune system is active, cancer can still progress. One reason may be due to the accumulation of MDSC that suppress CD8+ T cells. When the helper cells are suppressed, cancer cells and tumors will only progress. When the immune system can not fight cancer alone, chemotherapy is introduced to the body to help inhibit the progression of tumor development.

Cytotoxic chemotherapy drugs have shown change the way the immune system reacts to cancer. Chemotherapy medication directly alter the mechanics of tumor cell death and indirectly lower the number of immunosuppressive pathways. Both indirect and direct fashions of administering chemotherapy allows for helper cells CD8+ to do perform its function.

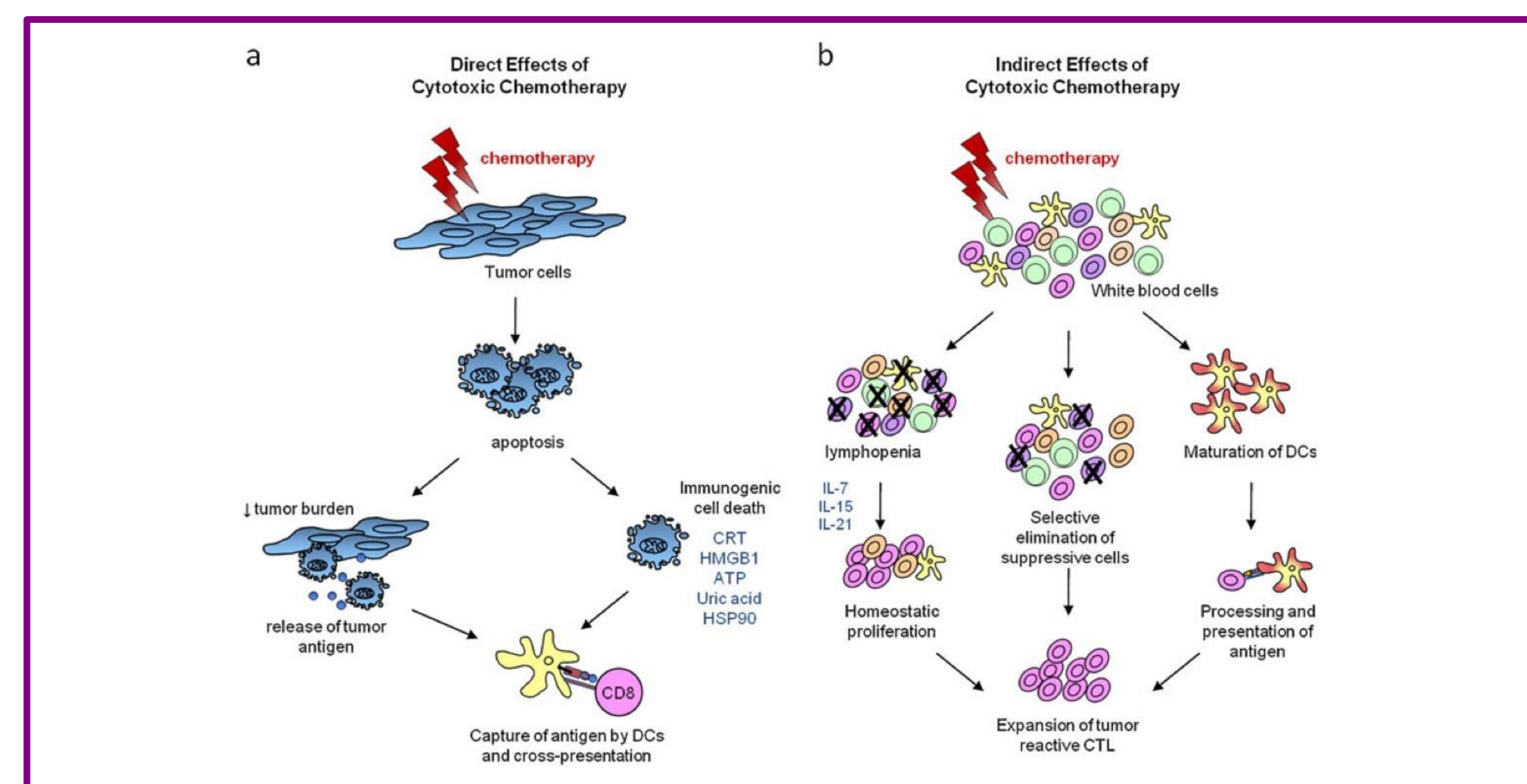
Direct:

Chemotherapy that is administered directly means that the cytotoxic drug goes directly to the tumor cell. When cytotoxic chemotherapy drugs kill a tumor cell through apoptosis, antigens are released. Dendritic cells uptake the antigens from the tumor cell and deliver them to naive T cells. Without an antigen hooked up to it, T cells have little function. However, when the naive T cell attains the cancer cell antigen, the immune system gets stimulated. The presence of the antigen results in the production of antibodies to fight off cancer cells.

In addition to stimulating more antibodies, when chemotherapy is administered in a direct fashion, it helps reduce the amount of tumor cells the immune system has to fight off, increases the amount of anti-tumor antigens, and results in immunogenic cell death.

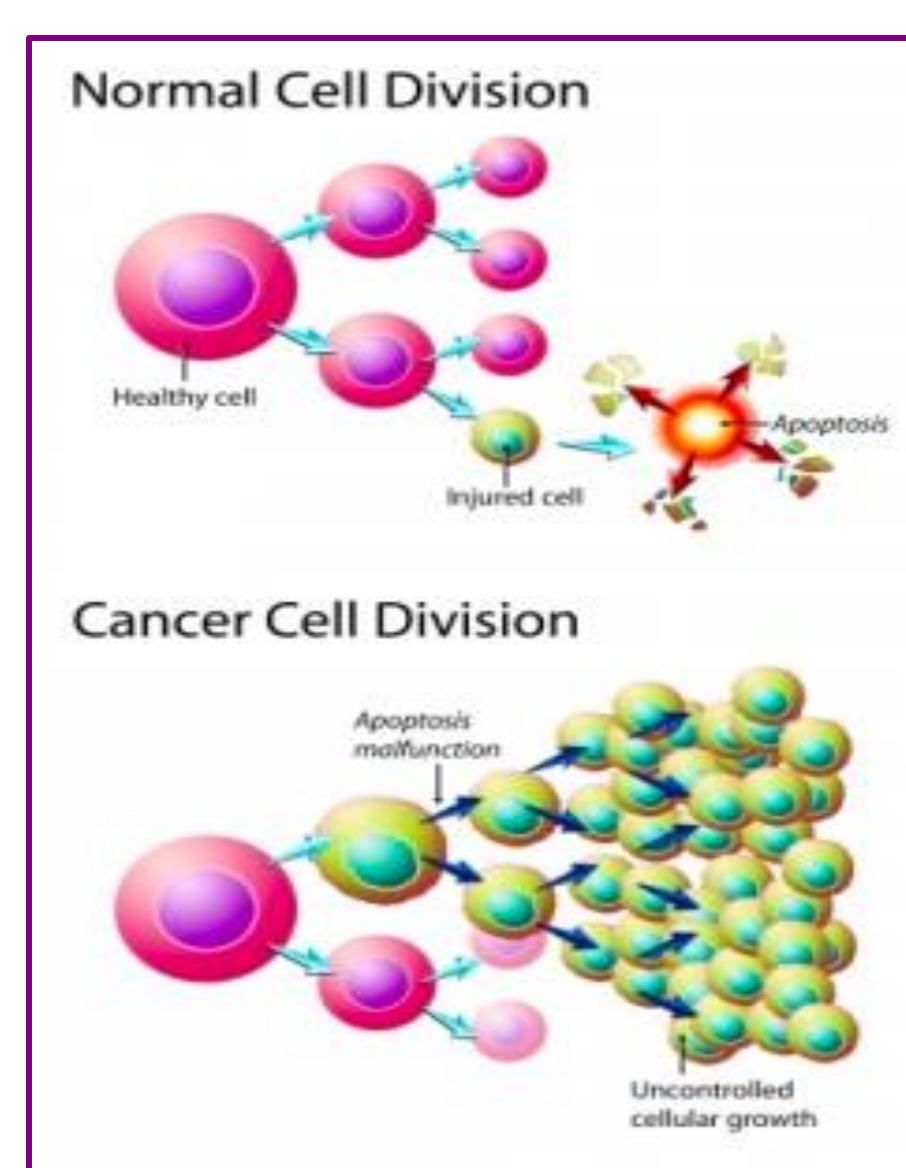
Indirect:

Chemotherapy that is administered indirectly means that the drug activates the immune system by going to the white blood cells. A couple of results occur due to this type of administration. First of all, certain suppressive cells are eliminated, for example MDSC. Indirect chemotherapy also results in the maturation of DC cells. DC cells are important to present antigens to T cells for the formation of antibodies.



Chemotherapy & Mitosis

Chemotherapy targets cancer cells. Cancer cells are fast growing cells that are undergoing mitosis because at the end of mitosis the original cancer cell is duplicated. Similar cells that undergo mitosis are hair, finger, and skin cells. This is why some patients lose hair when they undergo treatment.



Why Immune System is Needed:

Research states that an intact immune system is necessary for the elimination of cancer. A study done on mice with leukemia were given medication and due to the immune system, they built resistance against the cancer. Depending on the medication administered to the mice, a majority were cured. As we learned earlier chemotherapy drugs introduced to the body result in T cells gaining antigens which then antibodies are produced by the immune system to fight of tumor cells. This study shows that the immune systems of the mice build recognition of the cancer and are able to fight it off the second time cured mice are introduced to the leukemia cells. The ability for the immune system to recognize the tumor is called immunological memory. What further supports this idea is the fact researchers took a splenocyte from the mice that were cured from the leukemia and injected it to a mice that did not receive chemotherapy. These mice attained immunity from the cancer similar to the cured mice. In the end, chemotherapy does help eliminated the tumor cells, but with the help of a functioning immune system the body is more equipped to eradicate cancer cells. It is also important to know how the immune system functions with chemotherapy to know what medication should be given to patients since chemotherapy drugs are normally given more than one at a time.

Exercise Intervention to Beat Cancer-Related Fatigue

Intro: Many patients that have cancer suffer from cancer-related fatigue. A study, researched whether not supervised exercise would reduce their fatigue during the treatment and after the treatment. Researchers did a systematic review and analysis.

Methods: They looked at a total of 722 subjects. The types of exercises they looked at were aerobic exercise, resistance training, and stretching. The CRF was measured by using Functional Assessment of Cancer Therapy Fatigue scale for most of the studies.

Results: Supervised multimodal exercise helped lower cancer-related fatigue in cancer patient. Exercise intervention also lowers the chances of patients developing Cancer-Related Fatigue. In addition, patients will get relief from anxiety, depression, lack of sleep and mood swings.

References

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