



Fall 2018

Pediatric Cancers: Development and Treatment Methods

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Walker, MaKayla M., "Pediatric Cancers: Development and Treatment Methods" (2018). *Student Publications*. 679.
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Pediatric Cancers: Development and Treatment Methods

Abstract

Pediatric cancers are cancers that develop in kids and adolescents ages 0-19. Pediatric cancers usually develop in three ways: through inherited gene mutations, parental exposure to toxins, and acquired gene mutations. While cancer can affect children and adults alike, treatment becomes more difficult for children due to their physical predevelopment stages. Therefore, it is important to discuss all methods of treatment when dealing with a particular pediatric cancer in order to choose the most effective method.

Keywords

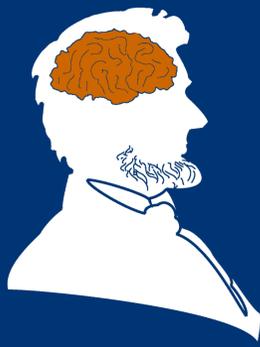
Pediatric Cancer, Cancer, Cancer Treatment

Disciplines

Diseases | Life Sciences | Medicine and Health Sciences

Comments

Written for FYS 155-2: Cancer in Society: A War Against Immortality and presented at the 2019 Celebration of Academic First-Year Engagement Symposium.



Pediatric Cancers: Development and Treatment Methods

MaKayla Walker



First Year Seminar: Cancer in Society, Gettysburg College, Gettysburg, PA

Overview

- Cancer is known to be a disease that requires multiple mutations to develop over a long period of time
- However, this mechanism of cancer does not hold true when discussing pediatric cancers
- Due to this phenomenon, researchers have discovered the primary factors that lead to the develop of cancer in children, as well as successful treatment methods suitable for young patients

Background

- Pediatric cancers are generally characterized as cancers that are present in children ages 0-15, but this characterization can also hold true for adolescents ages 15-19
- Pediatric cancers are very rare, but when they do arise in children, the disease impacts them more than it would in adults, due to the beginning stages of physical development
- Similar to adults, cancer can arise in children in a myriad amount of ways, but there are three focal causes that are the most prevalent

Pediatric Cancer Development

Inherited Gene Mutations

- Affected parent transfers germ cell mutation, which becomes present in the child's genome
- Not all mutations cause cancer, but the child is definitely at risk

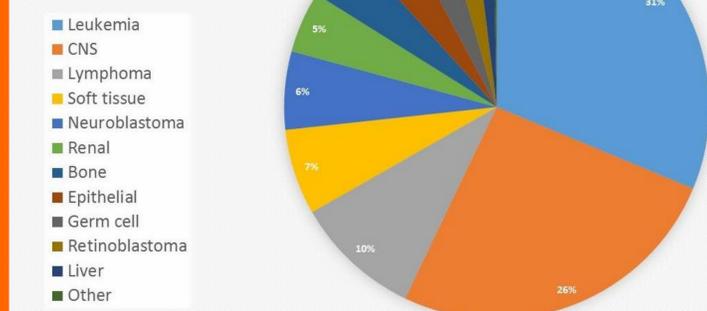
Parental Exposure to Toxins

- Higher instance of parental exposure to toxins leads to higher risk of mutation development in child
- Example: Mother that smokes may weaken child's lungs

Acquired Gene Mutations

- Proto-oncogenes can mutate into oncogenes
- Top three most common gene mutations: ETV6-RUNX1, Hyperdiploid, and MLL rearrangements

Age-Adjusted and Age-Specific Cancer Incidence Rates for Patients Aged 0–14 Years (SEER 2009–2012)



Leukemias

- Most are acute lymphocytic or acute myeloid leukemias
- Chronic leukemias are very rare in children
- Arises due to the acquired mutations of the ETV6-RUNX1 gene
- The ETV6-RUNX1 gene is a transcription factor, which means it binds to particular DNA sequences and prompts for DNA synthesis to occur
- A mutation in the ETV6-RUNX1 gene leads to uncontrolled synthesis of DNA, which leads to the over-proliferation of mutated cells in the bone marrow

Central Nervous System Cancers

- Develops when cells in the brain or spinal cord over-proliferate
- Affects patients' thought process and movement
- Challenging to treat because tissues surrounding affected area are crucial to the body's functioning
- Some inherited diseases, such as Turcot Syndrome and Nevoid Basal Cell Carcinoma Syndrome, increase child's risk of developing central nervous system cancers

Treatment Methods

Surgery

- Helps to identify type of cancer and how far it has spread
- If the cancer has not spread, affected tissue can be removed
- Can help to relieve discomfort and other symptoms caused by cancer
- Can help to prevent cancer from reoccurring

Chemotherapy

- Kills cancer cells that have metastasized to different parts of the body
- Goals are to ease symptoms, control metastasis, and ultimately cure the cancer

Radiation Therapy

- Radiation makes small breaks in DNA within cells, which triggers cancer cell apoptosis
- Radiation uses high energy particles to kill or damage cancer cells
- Goals of radiation therapy are to shrink or cure early stage cancer, treat symptoms, and treat cancer that has returned

Issues/Limitations

- Chemotherapy and/or radiation therapy can cause learning issues
- Chemotherapy and/or radiation therapy targeted at the head or neck can cause mouth sores, sensitive gums, tooth decay, and other physical effects
- Therapy may harm the body's production of red blood cells, which can cause patients to become anemic



Summary

- Like cancers in adults, pediatric cancers can develop in children similarly, in which proto-oncogenes mutate and transform into oncogenes
- Pediatric cancers are rare, but when they do occur, a particular method of treatment must be selected in order to prevent metastasis as well as reoccurrence
- Extra precautions must be taken when treating children with cancer, for it is important not to harm certain areas of the body that are vital to a child's physical development

Conclusions

- It is important to keep track of family history of cancer and other related diseases, for inherited gene mutations can be passed on and can affect children of later generations
- Keeping children in a clean and safe environment will limit increased exposure to particular toxins, which can also decrease their risk of developing cancer
- Chemotherapy and radiation therapy are the most invasive forms of treatment, but they are also the most effective

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Acknowledgments

- Kaylyn Trout contributed to the research involved and the development of this project
- Thank you to Professor Robert Garrity for assisting in the development of this project