C38 – PEDIATRIC CONSIDERATIONS AND CARE FOR RADIATION THERAPY

Objectives

- Explain radiation therapy as a modality
- Understand how radiation therapy is used for pediatric patients
- Identify the specific cancers used for radiation therapy in pediatrics
- Explain pediatric specific care for radiation therapy

What is radiation therapy?

- Radiation therapy, often referred to as radiotherapy, is a treatment within the radiation oncology department that uses ionizing radiation to treat malignant neoplasias (Washington & Leaver, 2017).

Sievers, K. S. (n.d.). *What is Radiation Therapy?* . University of Nebraska College of Medicine Department of Radiation Oncology . Retrieved from https://www.unmc.edu/radonc/patient-care/what_is.html.

Main goal of radiation therapy is to use the maximum amount of radiation required to eliminate cancerous cells with minimum damage to normal tissues in hand with immobilization techniques (Mehta et al., 2010).

Used to cure or shrink early-stage cancer, stop cancer from recurring, treat symptoms, alleviate pain (American Cancer Society, 2025).

Types of Radiation Therapy

External radiation therapy	A delivered dose from an outside source and directed at the cancerous site (NIH Nat. Cancer Institute, 2023). Most used form. Machines used: Linear accelerators, proton beam machines, Cobalt-60 (gamma ray) machines, and orthovoltage x-ray machines.
Internal radiation therapy	Also known as, brachytherapy. Placing radiation source internally as close to the cancer site as possible via seeds, needles, wires, or catheters. May at times be inserted directly into the tumor (NIH Nat. Cancer Institute, 2023). Can be used in conjunction with external beam therapy. Methods: interstitial, intracavitary, intraluminal, radio-tagged molecules given intravenously.

Radiation Therapy for Pediatrics

- Historically, there was a decrease in radiation therapy usage for pediatric cancers between the years of 1973-2008. Due to the increase of awareness to reduce the late effects of radiation in children. (Jairam et al., 2013).
- Why does this matter?
  - Acute side effects of radiation between adults and children drastically vary. Irradiation to growing tissues can result in significant anatomical or functional problems as they grow (Breneman & Narayana, 2003).

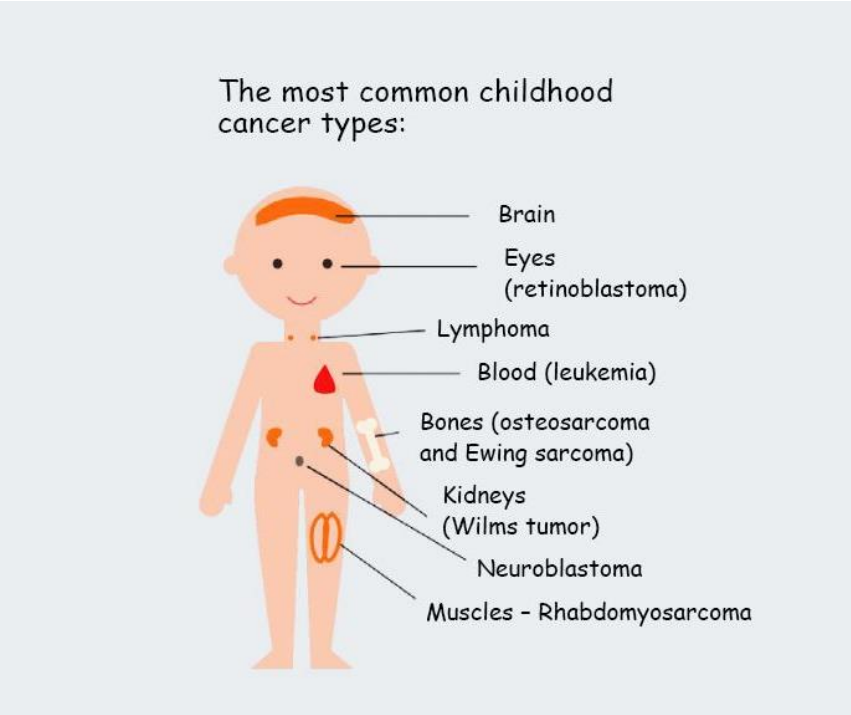
St. Jude's Children Research Hospital. (2016). *Children with Brain Tumors Undergoing Radiation Therapy Helped by Play-Based Preparation*. Medical Xpress. Retrieved from https://medicalxpress.com/news/2016-05-children-brain-tumors-therapy-play-based.html.

Radiation Therapy for Pediatrics

- In pediatrics today, it is used to treat common childhood malignancies while also finding new approaches to the technology. The fields responsibility is also addressing and minimizing risk for late effects in children (Gibbs et al., 2006).
- The balance is managing the risk of radiation with the benefit of treatment itself. “Local irradiation is fundamental to successful multi-disciplinary management” (Kun & Beltran, 2008).

Essential Role of RT. (2024). Retrieved from https://www.elekta.com/focus/radiotherapy-an-indispensable-modality-at-teletón-childrens-oncology-hospital/.

Pediatric Cancers



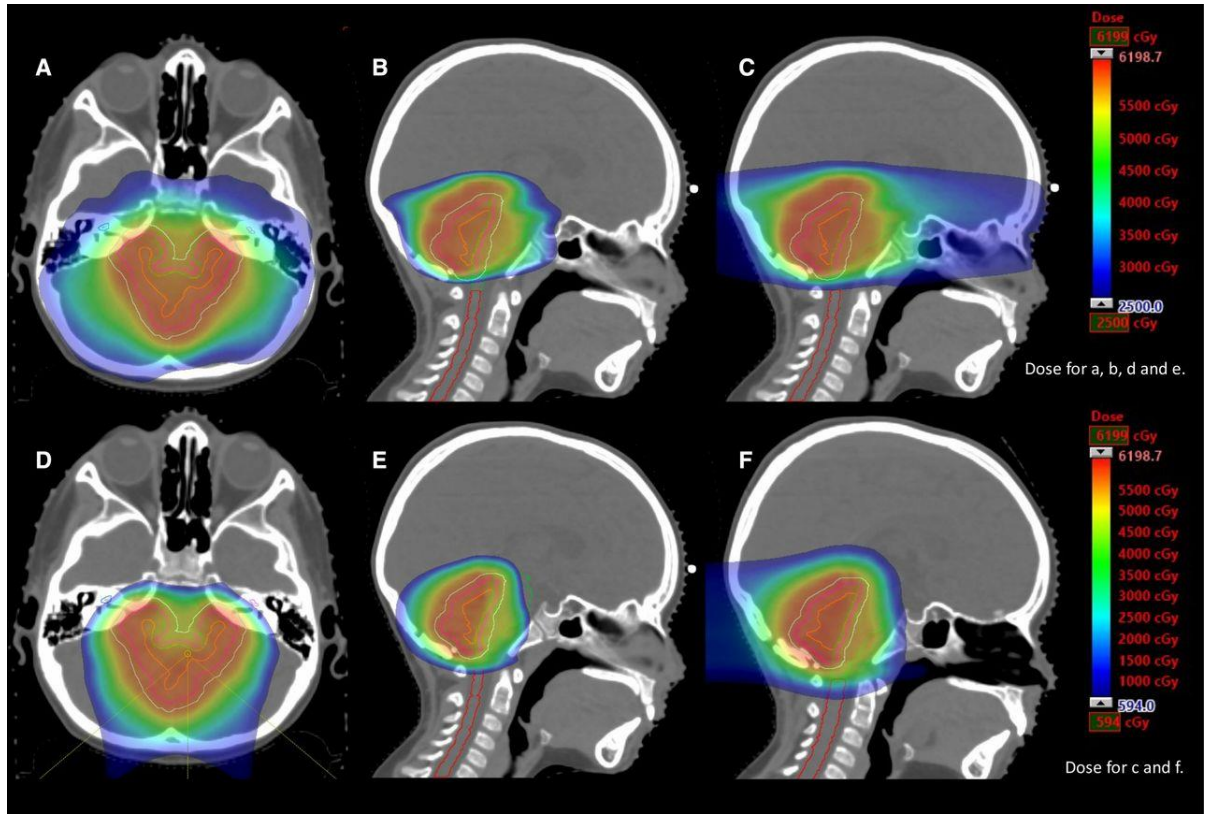
FLOGA. (n.d.). *Childhood Cancer*. FLOGA.org.gr. Retrieved from https://www.floga.org.gr/en/get-informed/childhood-cancer/.

- Most common types:
  - Leukemia/acute myeloid leukemia: starts in blood and bone marrow.
  - Brain and spinal cord tumors: most common type of solid tumor within children.
  - Neuroblastoma: cancer of immature nerve cells.
  - Wilms tumor and nephroblastoma: starts in one or both kidneys.
  - Lymphoma: cancer of lymphocytes.
  - Bone cancer: Osteosarcoma & Ewing Carcinoma.

(MSKCC, 2025).

Which pediatric cancers are treated with radiation?

- Central nervous system (brain and spine) tumor.
- Eye tumors (retinoblastoma).
- Lymphomas.
- Kidney cancer (neuroblastoma and Wilms' tumor).
- Head and neck tumors.
  - Including muscle and bone.
- Muscle tumors involving pelvis and extremities.



Borterberg, T., Dunlea, C., Harrabi, S., Janssens, G., Laprie, A., Whitfield, G., & Mark Gaze. (2022). *Contemporary Paediatric Radiation Oncology*. BMJ Journals: Archives of Disease in Childhood. Retrieved 2026,.

Considerations for Pediatric Care

Not every childhood cancer is treated with radiation therapy due to the risk of late effects on children and possibility of harming growing vital tissues and organs.

Radiation is extremely effective, but is a very high risk for harming healthy tissues and increasing risk of new cancer within the body (Ladra, 2026).

Research shows risk of radiation carcinogenesis for ages below 5-10 about ten to fifteen times greater than that of a middle-aged person (Kun & Beltran, 2008).

Pediatric Specific Care

Understanding immobilization vs restraint

Immobilization-
Rendering a child incapable of moving with said child's consent.

Restraint-
Use of physical force to stop movement of child without said child's consent.

Due to the precise nature of the radiation therapy beam, immobilization is paramount for best results of the treatment.

Ng, J. H., & Doyle, E. (2019). Keeping children still in medical imaging examinations- immobilisation or restraint: A literature review. *Journal of Medical Imaging and Radiation Sciences*, *50*(1), 179–187. https://doi.org/10.1016/j.jmir.2018.09.008

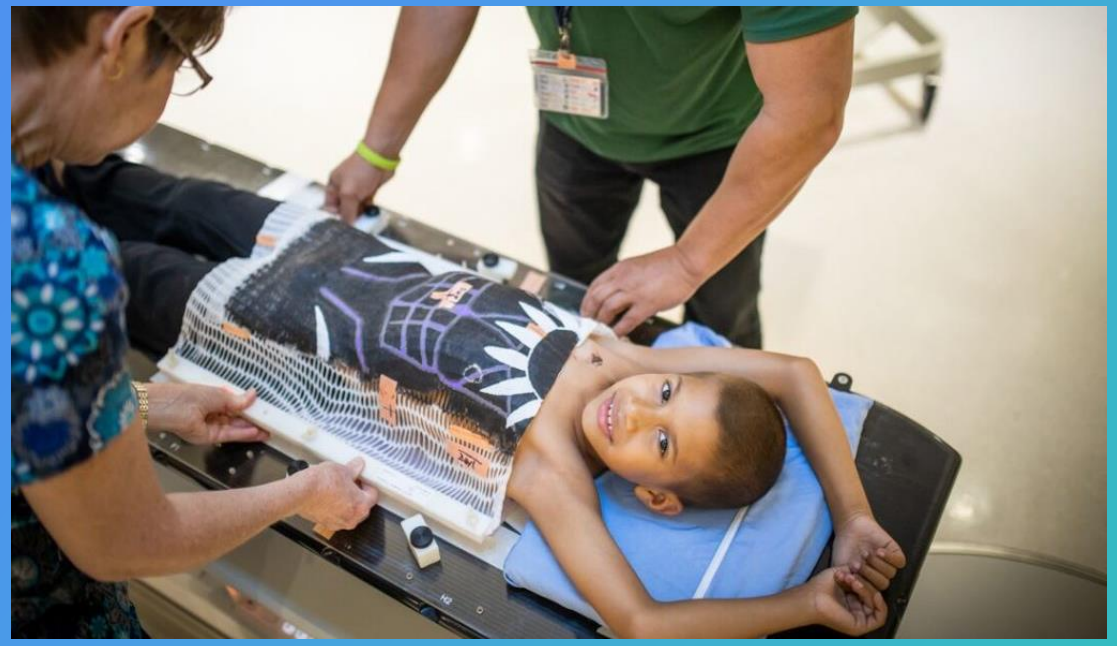
Pediatric Specific Care

Orfit Industries. (n.d.). *Why pediatric focused comfort matters*. Retrieved from https://www.orfit.com/radiation-oncology/get-inspired/tips-for-pediatric-radiation-therapy

As children get older, they are able to comprehend instructions better (Ng & Doyle, 2019). Though, precise and clear instructions for immobilization is of utmost importance.

Radiation therapy uses a variety of body molds/cradles, vacuum cushions, thermoplastic face masks, and bite blocks depending on where the cancer is located (Children's Wisconsin, 2026).

These immobilization techniques not only ensure safe, accurate treatment for children but minimize their physical and emotional discomfort or stress.



Stancati, A. (2019, September 3). *Superhero patients get custom radiation "capes."* Hamilton Health Sciences. https://www.hamiltonhealthsciences.ca/share/pediatric-radiation-superheroes/

Pediatric Specific Care

- An ethical responsibility of a radiation oncology team member is to make sure patients are comfortable in spaces where medical services are provided.
- Certain hospitals are front running this effort by creating pediatric friendly, and fun, twists to their immobilization devices
  - Seen on the left, termed radiation "Super-Hero Capes"

Conclusion:

- Radiation therapy's goal as a modality is to eliminate cancer cells with ionizing radiation either alone or in conjunction with other cancer treatments such as surgery, chemotherapy, and immunotherapy.
- In today's era of ALARA, radiation is given when benefits outweigh risks to pediatric patients due to late effects.
- Not every childhood cancer benefits best from radiation therapy.
- Immobilization is using tools to keep a child still during treatment with their consent.
- Immobilization tools are paramount for radiation therapy, but pediatric care requires more discernment in how they are employed.
- Pediatric patients require physical and emotional safety during treatment.

REFERENCES:

American Cancer Society medical and editorial content team, & American Society of Clinical Oncology. (2025, June 9). *Radiation Therapy* . Radiation | American Cancer Society. https://www.cancer.org/cancer/managing-cancer/treatment-types/radiation.html

Borterberg, T., Dunlea, C., Harrabi, S., Janssens, G., Laprie, A., Whitfield, G., & Mark Gaze. (2022). *Contemporary Paediatric Radiation Oncology*. BMJ Journals: Archives of Disease in Childhood. Retrieved 2026,.

Breneman, J., & Narayana, A. (n.d.). Chapter 137C Principles of Pediatric Radiation Oncology. essay.

Children's Wisconsin. (2026). *Radiation treatments*. Treatment for cancer | Children's Wisconsin. https://childrenswi.org/find-care/macc-fund-center/childhood-cancer/radiation

Essential Role of RT. (2024). Retrieved from https://www.elekta.com/focus/radiotherapy-an-indispensable-modality-at-teletón-childrens-oncology-hospital/.

FLOGA. (n.d.). *Childhood Cancer*. FLOGA.org.gr. Retrieved from https://www.floga.org.gr/en/get-informed/childhood-cancer/.

Gibbs, I. C., Tuamokumo, N., & Yock, T. I. (2006). Role of radiation therapy in pediatric cancer. *Hematology/Oncology Clinics of North America*, *20*(2), 455–470. https://doi.org/10.1016/j.hoc.2006.01.015

Jairam, V., Roberts, K. B., & Yu, J. B. (2013). Historical trends in the use of radiation therapy for pediatric cancers: 1973-2008. *International Journal of Radiation Oncology*Biology*Physics*, *85*(3). https://doi.org/10.1016/j.ijrobp.2012.10.007

Kun, L. E., & Beltran, C. (2008). Radiation therapy for children: Evolving Technologies in the era of alara. *Pediatric Radiology*, *39*(S1), 65–70. https://doi.org/10.1007/s00247-008-1098-0

Ladra, M. (n.d.). Proton therapy for treating childhood cancer | Johns Hopkins Medicine. https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/proton-therapy-for-treating-childhood-cancer

REFERENCES:

Mehta, S., Suhag, V., Semwal, M., & Sharma, N. (2010). Radiotherapy: Basic concepts and Recent Advances. *Medical Journal Armed Forces India*, *66*(2), 158–162. https://doi.org/10.1016/s0377-1237(10)80132-7

Ng, J. H., & Doyle, E. (2019). Keeping children still in medical imaging examinations- immobilisation or restraint: A literature review. *Journal of Medical Imaging and Radiation Sciences*, *50*(1), 179–187. https://doi.org/10.1016/j.jmir.2018.09.008

NIH National Cancer Institute. (2023). *Types of Radiation Therapy*. Types of Radiation Therapy | SEER Training. https://training.seer.cancer.gov/treatment/radiation/radiation-types.html

Orfit Industries. (n.d.). *Why pediatric focused comfort matters*. Retrieved from https://www.orfit.com/radiation-oncology/get-inspired/tips-for-pediatric-radiation-therapy.

Pediatric radiation therapy. Memorial Sloan Kettering Cancer Center. (n.d.). https://www.mskcc.org/pediatrics/cancer-care/treatments/cancer-treatments/pediatric-radiation-therapy

Sievers, K. S. (n.d.). *What is Radiation Therapy?* . University of Nebraska College of Medicine Department of Radiation Oncology . Retrieved from https://www.unmc.edu/radonc/patient-care/what_is.html.

St. Jude's Children Research Hospital. (2016). *Children with Brain Tumors Undergoing Radiation Therapy Helped by Play-Based Preparation*. Medical Xpress. Retrieved from https://medicalxpress.com/news/2016-05-children-brain-tumors-therapy-play-based.html.

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Washington, C. M., & Leaver, D. T. (2017). *Principles and practice of radiation therapy*.