Nuclear Technology in Medicine

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Nuclear technology is a field that is growing and advancing rapidly. Since the first use of nuclear technology in medicine by Dr. Sam Seidlin in 1943, nuclear technology has become rapidly more widespread. New uses came to light very quickly in the 1950s with the introduction of the field of radiology and has since made its way into many aspects of treatment and diagnostics. Today, nuclear technology is commonly used to treat cancer and its symptoms and to non-invasively diagnose issues with bones, organs, and other inner-body functions.

Dr. Sam Seidlin is credited as the first user of nuclear medicine. In 1943, he used a radioactive isotope of iodine (I-131) to treat a patient's advanced thyroid cancer (Mandal, Ananya, 2019) a practice still used today. Since then, nuclear technology has been used to treat cancer cells and to lessen the size of tumors (National Cancer Institute, 2019), what we often refer to today as radiation therapy. There are two main types of radiation therapy: external beam and internal.

Internal radiation therapy is administered into the body and can be taken in as a solid or a liquid. The solid form of internal radiation therapy, known as brachytherapy, can allow one to withstand higher doses of radiation because it is delivered "directly to the treatment area" (Mayo Clinic, 2022). Brachytherapy is commonly a surgical procedure in which the surgeon will place a solid, such as a seed, wire, or ribbon, directly into the affected area, and leaving it inside of the patient to combat the cancer cells. One of the main benefits for choosing the brachytherapy route is the possibility for permanent treatment, generally a practice used for prostate cancer. Brachytherapy is commonly used to treat types of cancers such as brain cancer, breast cancer, esophageal cancer, and many others.

Additionally, internal radiation therapy can be administered as a liquid, a process known as systemic radiation therapy. Systemic therapy treatment travels throughout the body, "seeking

out and killing cancer cells" (National Cancer Institute, 2019). One can take this type of treatment by mouth or through the vein via an IV line or an injection. Systemic therapy can also be used to locate cancer and other non-cancer related health problems by collecting in areas where cancer cells are located (American Cancer Society, 2019). It is important to note that with brachytherapy and systemic therapy, patients can be radioactive immediately after receiving treatment. It is often advised to remain distant from small children and pregnant women in the days following treatment, and radiation is often released though bodily excrements like sweat, blood, and urine, which should be handled with the proper instruction in the days following treatment.

Radiotherapy can also be administered externally. This is known as external beam radiation therapy, which is administered through a machine, usually a linear accelerator (National Cancer Institute, 2019). External beam radiation therapy is a very local treatment, meaning, the radiation is focused only on the target area. The machine will administer "high energy x-ray or electron beams to a patient's tumor" (Radiological Society of North America, 2019). External beam therapy can be used to treat cancer located in the breasts, lungs, head and neck, prostate, and even the brain. Since there is no source of radiation present in the patient's body, the cells are only affected for a very short amount of time, meaning patients are not considered "radioactive" during or after treatment, as opposed to that of internal therapy.

There are multiple ways to treat cancer and non-cancer related health issues through radiation, but it is just as important to diagnose these issues to determine the path of treatment. Radiation can be useful in this instance as well. One of the most common types of scans using radiation is the x-ray. Almost everyone has had one at some point, and they are very common to use when evaluating bones and teeth. X-rays are also important when screening women for

breast cancer, a type of imaging known as mammography (CDC, 2022). Additionally, DEXA Scans, CT scans are commonly used to help diagnose internal issues without invasion. DEXA is an acronym for “dual-energy X-ray absorptiometry” (Cleveland Clinic, 2020), and is a type of medical scan that evaluates bone density. They do this by measuring the mineral content in the patient’s bones, by passing x-rays through the bones, a useful way of diagnosing osteoporosis.

Additionally, computerized tomography, commonly known as CT scans, are used to create “cross sectional images of bones, blood vessels, and soft tissues inside the body” (Mayo Clinic, 2022). These types of scans consist of a combination of computer technology and x-rays, but are much more detailed than the typical x-ray scan (Johns Hopkins,). CT scans are often administered to allow physicians to identify possible abnormalities or tumors better than a traditional x-ray can, due to the 3D image that the scan produces (U.S. Department of Health and Human Services, 2022). These types of scans are very useful when diagnosing a variety of issues. Since the amount of radiation administered through these scans is relatively low, the patient is not harm in any way, nor are they considered “radioactive."

Since its introduction to the medical field in 1943, nuclear medicine has made significant advancements in the lives of patients everywhere. Essentially every field of medicine uses nuclear medicine in some way, whether it be x-rays or otherwise. These types of nuclear technologies have allowed for treatments to difficult diseases like cancer and the ability to diagnose illnesses that would otherwise be extremely difficult to identify. Although widespread, nuclear technology advancements in medicine are still a touchy subject for some. There is a common misconception that nuclear medicine can be harmful to patients, but that is simply not the case. The advancement of nuclear technology has made treating previously impossible to

treat diseases combatable and has opened the world to diagnostics that could never be possible without nuclear technology.

Works Cited

American Cancer Society. (2019). *Systemic radiation therapy: Getting oral radiation therapy*. Systemic Radiation Therapy. Retrieved from https://www.cancer.org/treatment/treatments-and-side-effects/treatment-types/radiation/systemic-radiation-therapy.html

Centers for Disease Control and Prevention. (2021, October 20). *Radiation in healthcare: Mammogram*. Centers for Disease Control and Prevention. Retrieved from https://www.cdc.gov/nceh/radiation/mammogram.html

Dexa Scan (DXA): Bone Density Test, what is it & how it's done. Cleveland Clinic. (2020). Retrieved from https://my.clevelandclinic.org/health/diagnostics/10683-dexa-dxa-scan-bone-density-test

Mandal, D. A. (2019, February 27). *History of nuclear medicine*. News. Retrieved from https://www.news-medical.net/health/History-of-Nuclear-Medicine.aspx#:~:text=Nuclear%20medicine%20first%20became%20recognised,patient%20with%20advanced%20thyroid%20cancer.

Mayo Clinic. (2022, November 22). *Brachytherapy*. Mayo Clinic. Retrieved from https://www.mayoclinic.org/tests-procedures/brachytherapy/about/pac-20385159#:~:text=Brachytherapy%20(brak%2De%2DTHER,is%20more%20common%20than%20brachytherapy.

Mayo Foundation for Medical Education and Research. (2022, January 6). *CT Scan*. Mayo Clinic. Retrieved from https://www.mayoclinic.org/tests-procedures/ct-scan/about/pac-20393675

Radiation therapy for cancer. National Cancer Institute. (2019). Retrieved from https://www.cancer.gov/about-cancer/treatment/types/radiation-therapy#:~:text=Radiation%20therapy%20(also%20called%20radiotherapy,your%20teeth%20or%20broken%20bones.

Radiological Society of North America (RSNA) and American College of Radiology (ACR). (2019). *External Beam therapy (EBT)*. Radiologyinfo.org. Retrieved from https://www.radiologyinfo.org/en/info/ebt

U.S. Department of Health and Human Services. (2022). *Computed Tomography (CT)*. National Institute of Biomedical Imaging and Bioengineering. Retrieved from https://www.nibib.nih.gov/science-education/science-topics/computed-tomography-ct