

A Brief History of Radiation Oncology

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Radiation has been an ever present ingredient in the evolution of life on earth. It is not something new, invented by human ingenuity in the technologic age; it has always been there. What is new is the extra radiation we are subjected to, largely for medical purposes, but also from journeys in jet aircraft and from nuclear reactors used to generate electrical power. In 1896 a physics professor, Wilhelm Conrad Roentgen, presented information on a new kind of ray. Roentgen called it the x-ray. He found that this new ray could blacken photographic film and pass through materials including cardboard and wood. He made the first display of a bony structure by putting his colleague's hand in front of the x-ray machine and a photographic film behind. There was much excitement around this new ray and within months machines were being developed for its use in diagnosis and within three years x-ray radiation was being used to treat cancer.

Parallel to the discovery of x-rays, was the discovery of radioactivity in 1898 with the discovery of Radium. Radium was discovered by Marie and Pierre Curie in 1898. Brachytherapy which is known as implant therapy underwent a similar evolution and was first used in the early 20th century. In the beginning brachytherapy used radium as the main source of treatment. It was found that better results could be achieved by using this implant therapy by putting radiation directly into and around the tumor without passing through a lot of normal tissue.

In France a breakthrough occurred in the early 1900's when it was discovered that instead of a few large doses of radiation that several weeks of radiation decreased side-effects and increased the patient's chance for cure.

In the wake of WWII and the use of atomic weapons on Hiroshima and Nagasaki, research into the effects of radiation on cells developed quickly. This ushered in the foundation for understanding the biology of how radiation works on normal and tumor cells ie: the field of radiation biology was born.

Since then we have come a long way developing machines and methods that have improved side effects and improved chances for cure.

I believe it is important to understand how far we have come in a relatively short space of time. To see where we were 25 years ago when I started out in this field and where we are now is mind boggling. I wish I had a crystal ball to see where things will be 25 years from now. The technology continues to advance very quickly with the end result of more and more options in the treatment of breast and other cancers.

Advances in radiation physics and computer technology during the last quarter of the 20th century made it possible to aim radiation more precisely. The following are techniques commonly used with this in mind.

- **Conformal radiation therapy (CRT)** uses CAT scan images and special computers to very precisely map the location of a cancer in 3 dimensions. The patient is fitted with a plastic mold or cast to keep the body part still and in the same position for each treatment. The radiation beams are matched to the shape of the tumor and delivered to the tumor from several directions.
- **Intensity-modulated radiation therapy (IMRT)** is like CRT, but along with aiming high energy x-ray beams from several directions; the intensity (strength) of the beams can be adjusted. This gives even more control in decreasing the radiation reaching normal tissue while delivering a high dose to the cancer.

- A related technique, **conformal proton beam** radiation therapy, uses a similar approach to focusing radiation on the cancer. But instead of using x-rays, this technique uses proton beams.
- **Stereotactic radiosurgery and stereotactic radiation therapy** are terms that describe several techniques used to deliver a large, precise radiation dose to a small tumor. The term *surgery* may be confusing because no cutting is actually done.
- **Intraoperative radiation therapy (IORT)** is a form of treatment that delivers radiation at the time of surgery. The radiation can be given directly to the cancer or to the nearby tissues after the cancer has been removed.
- **Brachytherapy** is a treatment where radioactive seeds or sources are placed in or near the tumor itself, giving a high radiation dose to the tumor while reducing the radiation exposure in the surrounding healthy tissues.
- All of the above treatments can be used for breast cancer. The question is how to decide which is best for you. This is where your cancer team can help guide your decision.