THE IMPORTANCE OF LINEAR ACCELERATORS

by Gil Lederman M.D.

One of a cancer program's important components is the linear accelerator. It is often, in addition to the personnel, the crown jewel.

A linear accelerator is a radiotherapy machine that produces high energy x-rays and electrons for cancer treatment. High-energy beams penetrate deep into the body sparing superficial tissues, while electrons penetrate only superficially sparing deeper structures. Different energy beams allow a variety of such combinations.

The linear accelerator represents a commitment and not just a purchase. It reflects the hospital's dedication to quality patient care that is reliable, accurate, reproducible and equal to that in the most prominent cancer centers across the world.

It is a bulky machine weighing thousands of pounds but moving with tremendous precision so that its beam can rotate precisely around the head of a pin. This accuracy is mandatory especially in such sophisticated treatment as that involving stereotactic radiosurgery - where small pencil-thin beams of radiation are directed to abnormalities within the head. Areas of concern can be targeted while normal tissues are protected from the high energy beam.

Electrons are the portion of the atom that revolve around the nucleus or center - much like the planets around the sun. In a linear accelerator, it is electrons that are injected into a wave guide and accelerated close to the speed of light giving them a tremendous amount of energy. When electrons strike a target, they produce an x-ray beam. If the electrons are going to be used for treatment, then the target is removed and the electrons emerge.

Linear accelerators require a great amount of routine upkeep. Patients are often told that running a linear accelerator is much like getting a rocket blast off and return safely each day. Because of the complexity of the equipment and the importance - human lives being dependent on the reliable function of the linear accelerator – Radiosurgery New York bought what was felt to be the most reliable unit and sophisticated - the Varian 2100C.

Radiation is generally given in a known number of treatments over a set period of time. It is well known that delay in the administration of radiation can impact dramatically on the desired successful outcome.

Prolonging of a prescribed treatment course can have harmful effects because cancer cells might regrow while treatment is not being delivered. This fact emphasizes the need for reliability.

As Ed Ginzton, one of the collaborators in the development of the linear accelerator, stated "I now think that the Varian Clinic medical linear accelerator is one of the most important things that has been accomplished with the aid of electronics. Already it has affected the lives of tens of thousands of individuals - those who have been successfully treated and their families and others close to them. One cannot put monetary value on the savings of lives or the easing of pain."

The legacy of the Varian is rich. The state-of-the-art model is the 2100C which produces two different x-ray beams and as well, multiple electron beams for more superficial treatment. It has stable, precise beams that offer reliable daily treatments - all computer-based. It is at the most sophisticated cancer centers across the world. There are a full complement of treatment beams in patient set-up geometries for all types of therapy ranging from the simple to the complex.

Radiation at high dose rates are important when using special wedges or treating at extended distances. Also, treating patients who otherwise would have difficulty remaining still for extended periods of time can be best performed with such sophisticated equipment.

Nearly as important as the linear accelerator is the couch or the table that the patient lies on during treatment. The couch should offer fast, precise positioning for the greatest variety of treatment fields. Not only is it very stable but rigid which is crucial in maintaining reproducible set-ups. Daily treatment set-up is critical in maintaining accuracy of the field. This is important for patient comfort and outcome.

Because the Varian 2100C linear accelerator is fully operational 99% of the time, patients can be assured of timely therapy. While no one can predict the future, the past and present track record of this linear accelerator is indicative of effective, reliable and dependable treatment for those in need.

At Radiosurgery New York we rely on state-of-the-art technology including linear accelerators, multileaf collimators, sophisticated computers but most of all it is the relationship between the physician and the patient. We believe we have the largest experience worldwide using fractionated stereotactic radiosurgery for treatment of brain and body cancers. We have the largest experience worldwide treating acoustic neuromas, a benign tumor affecting the 8th cranial nerve.

Treatment options certainly exist and we encourage patients to investigate each treatment option and technology before committing oneself. We have a hot line to ask questions: 212-CHOICES or e-mail questions to gil.lederman@rsny.org. We also have seminars on a regular basis that are open to the public.