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Stereotactic radiosurgery and radiotherapy in Panama

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Jasmina Alexander
Radiology and Radiation Therapy Technician, USA

Correspondence: Jasmina Alexander, Novalis Treatment Center, Panama City, Punta Pacifica John Hopkins Hospital, Basement 2, Panama, USA, Tel 507 396 3162, Email jasminaalexander@radiocirugiapanama.com

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Radiosurgery

Is the name of the medical procedure of radiotherapy in which fine beams of radiation generated in megavoltage units (cyclotron, Gamma Knife and the linear accelerator (LINAC), by multiple converging and shaped fields which is achieved radiate administered high and precisely located in a specific area or anatomical structure, avoiding toxic dose administration too.

Radiosurgery involves the use of complex, sophisticated and high-precision instruments, such as stereotactic devices, linear accelerators, the gamma knife, computers and lasers. High precision irradiation is planned by the radiation oncologist or radiation oncologist based on images, such as computed tomography (CT), magnetic resonance imaging (MRI) and angiography. The radiation is applied from an external source, under the precise specialized apparatus for mechanical orientation. Multiple beams (collimated) walks through the intracranial or extracranial where they accumulate try reaching the level needed to damage cells injury. Thus, healthy tissues around the target are relatively safe to receive non-lethal dose of radiation.

Abbreviations: LINAC, linear accelerator; CT, computed tomography; MRI, magnetic resonance imaging

Stereotactic surgery

It is a type of minimally invasive surgery that uses a three-dimensional coordinate system to locate small structures within the body and to perform actions such as ablation (removal), biopsy, lesion, injection, stimulation device implantation, radiosurgery etc. From the Greek στερεός "tough, stiff" stereos and τάξις taxis "ordination". In theory, any organ may be involved by stereotactic surgery. However, the difficulty to get a good reference system (such as the reference points of the bone, which keep a constant spatial relationship relative to soft tissue), make this type of surgery is applied only to the neurosurgery. Besides brain biopsies and routinely breast surgeries are done. To help the process, you can use X-ray imaging (mammography) or computerized axial tomography.

Stereotactic radiosurgery

Stereotactic radiosurgery is very useful for the treatment of tumors, both benign and malignant. Most of malignant brain tumors discussed is those with brain metastases. It involves the application of a single dose of high-energy radiation to the tumor or arteriovenous malformation. Although the term implies surgery, no incision at all and is done on an outpatient basis. Radiation beams used to eliminate, reduce or prevent tumor growth or eliminating cells interfering with their reproduction. Stereotactic radiosurgery has also been used to treat other cancers, high doses of radiation supplied exclusively to tumors in the body. Before the development of this method, the best alternative was a standard external beam radiation, so that exposure to radiation is much higher, causing more problem for patients.

Stereotactic radiotherapy

Stereotactic radiotherapy enables the administration of the same amount of radiation (or higher) than conventional radiosurgery, but is applied in small doses distributed in a series of daily treatments (split dose). The dose fractionation promotes repair of healthy tissue near the injury, especially critical structures such as the optic pathway or brain stem.

True beam STx

For treatment with Stereotactic Radiosurgery and Radiotherapy in Novalis Treatment Center of Panama there's the equipment True Beam STx that is the latest in advanced technology. Being a powerful radiosurgery system noninvasive True Beam STx destroys cancerous and benign tumors with beams of high-dose radiation with high precision and minimizes damage to healthy tissue. This pinpoint accuracy allows our doctors treat tumors difficult to access that may have been impossible to treat in the past. By delivering beams of radiation doses that match the shape of the tumor to be treated, True Beam STx also reduces treatment time. A typical session lasts about 15 minutes, reducing potential errors that may occur in longer procedures. Most patients return immediately after treatment and resume their normal activities immediately. There may be side effects such as fatigue, but these are usually mild and temporary.

Why true beam STx for stereotactic radiosurgery and radiotherapy?

True Beam STx provides noninvasive malignant and benign tumors and lesions located in the head and neck and whole body treatment offers an important treatment option, especially for patients with inoperable tumors or complex, or those seeking an alternative to conventional surgery or radiation therapy surgically. True Beam STx treatment also carries much less risk of complications than conventional surgery.

Greater accuracy and best beam forming

Unlike conventional accelerators that exist today, the True Beam STx is a versatile integrated guided radiotherapy and radiosurgery

image moving tissue may be treated with levels of precision and speed unprecedented platform. With the help of their HD 120 MLC, allowing a perfect form fields to previously impossible to treat injuries and other accelerators at present, there is only option for radiosurgery treatments circular; Added to this, True Beam STx has two FFF energy for HIM (High Intensity Modulated) allowing dose rates up to 1400 UM/min with FFF 6x power until 2400 UM/min with energy 10xFFF.

With this system the treatments are shortened by 50% compared to the times employing conventional technology, which is not only more comfort for the patient but a much more effective because the tumor has less time to move (due to movement body produced by respiration and other factors) at the time when you are receiving a radiation dose. The team has four independents location systems and control allowing develop different types of IGRT, or Image Guided Radiation Therapy, specially adapted to the characteristics of each patient: Planar X-ray Image or megavoltage (kV or MV) allows placing the patient using bony landmarks in treatment and perpendicular planes.

a. Cone beam CT or cone beam computed tomography: allows a TC in the treatment room, identifying bony structures and soft tissues of the patient.

b. Exac Trac X-ray Brain Lab: X-ray locator mounted in the treatment room and independent throttle. Allows the location of the area treated by bone structures or implantable markers.

c. Stereoscopic Images via infrared. Allows detecting movement of the surface of the patient and three-dimensional reconstruction by following the movement of the tumors and organs at risk (respiratory gating and tracking). Allowing only radiation emanating while the lesion is within the radiation beam.

d. By using these imaging techniques simultaneously to the treatment radiation can be synchronized with the respiratory organ movement (Respiratory Gating) allowing adaptation exceptional reducing treatment and irradiation of healthy tissues.

https://www.youtube.com/watch?v=m8rkg1WRDWg

Automated system and workflow

Also this new technology, which the manufacturer calls "smart" and "intuitive", reduces the number steps required to place the patient, obtain the images and perform the treatment. Consequently treatment intensity modulated radiation therapy dose that lasts ten minutes in a conventional accelerator can be done with True Beam STx in just two minutes. Also, a complex radiosurgery can now assume an intervention of 40 minutes to an hour can be completed within only 5-20 minutes with the new accelerator.

https://www.youtube.com/watch?v=oWgXAMAUziw

Supervisor control system and beam

In practice, the enormous precision True Beam STx with his image guidance system allows specialists to treat a tumor in motion, for example in the lung, with the same efficiency as if the body were static. This is possible, inter alia, due to the greater precision of the radiation beam (sub-millimeter) and the fact that the apparatus monitors the progress of each treatment once every ten milliseconds because of its sampling points 100,000 that provide data constantly. In turn, the X-ray tube leading-edge accelerator installed to control patient positioning allows imaging in three dimensions in 60% less time and at a rate of 25% less radiation.

Greater advanced radiosurgery

Varian Medical Systems and Brain lab combine True Beam STx with Novalis radiosurgery program. Powered by True Beam STx novalis offers medical and capacity radiosurgery image orientation and designed for selective SRS SBRT treatments. This system includes technology x-ray images and HD120 MLC multileaf collimator beam Varian high-resolution shaping treatment planning and ExacTraciPlan® Brain lab.

Novalis Radiosurgery Program includes a full suite of clinical applications, workflow, knowledge base and training of radiosurgery. The True Beam STx is specially configured for advanced radiosurgery and is designed to treat a moving target with unprecedented speed and accuracy. The True Beam STx combined with Novalis Radiosurgery Program provides a stronger and wider platform for innovation in neurosurgery. The combination of these leading technologies help in the important clinical advances in the fight against cancer and other neurological diseases. The goal is to increase access to advanced treatment. Powered Brain lab a less invasive treatment is provided. We have image-guided systems and software that provide real-time information used for planning and execution of radiosurgery.

How true beam STx work?

During treatment sessions with TrueBeamSTx, you lie on a treatment table while the machine rotates around you and the delivery of radiation is directed from various angles. True Beam STx has the ability to "modular" radiation beams allowing to match the shape of the tumor. The radiation beam is sculpted to match the three dimensional shape of the tumor, helping to protect healthy tissue and critical organs. The cumulative dose of radiation delivered kills tumor cells and minimizes exposure to surrounding healthy tissue. The number of treatments varies according to tumor size, location and shape.

https://www.youtube.com/watch?v=gjAyfhRAtAA

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None.

Conflicts of interest

Author declares that there is no conflict of interest.