

# FRACTIONATED RADIOSURGERY FOR BRAIN METASTASES

by Gil Lederman

Studies from across the world have shown stereotactic radiosurgery's effectiveness as treatment of brain metastases. Brain metastases are cancer cells that have spread through the bloodstream to deposit and grow in the brain.

The standard of care for patients with brain metastases has been radiation of the entire brain. The rationale for this is that while one or several nodules of cancer are seen, in fact, microscopic cells may be present but radiographically invisible elsewhere in the brain.

Radiosurgery is pencil-thin radiation beams directed from thousands of different angles to attack tumors anywhere in the brain. The radiation dose to the normal brain is reduced to an inconsequential amount whereas at the point of convergence of all the beams a huge radiation dose is administered. This is the basis of stereotactic radiosurgery.

Brain metastases are an excellent target for radiosurgery. They are usually spherical, have blood supply from the periphery and are often resistant to standard therapy. It is estimated fifty percent of patients with brain metastases may die with uncontrolled disease in the brain using standard techniques. If the metastases cannot be contained or eliminated, damage to the normal brain may occur often with dire consequences.

Stereotactic radiosurgery is perfect to boost radiation dose to brain metastases. The goal is to protect the patient's brain and neurologic function which should maintain or improve quality of life and prolong the length.

A recent study by Laing et al, evaluated 24 patients with 28 brain metastases using fractionated stereotactic radiosurgery. The range of patient age was 20 to 80 years (median 58). While many patients had a single lesion, several had multiple. The size of metastasis treated ranged up to five centimeters (about two inches).

The origin of the cancer was lung carcinoma in 42% and breast cancer in 21%. Other cancers had commenced growth in the kidney, uterus, salivary gland, colon, bladder and testes. All were treated using the removable, relocatable, headframe.

Three of the four groups of patients treated in this study received whole brain radiation. Two groups received whole brain radiation and radiosurgery at time of diagnosis. Another group had received whole brain radiation in the past and subsequently developed recurrent disease. Further whole brain radiation was not feasible.

The whole brain can tolerate only a certain amount of external beam radiation. Increasing the doses of standard whole brain radiation is highly likely to cause harm defeating the whole purpose of the medical profession's attempt to maintain life. This is why more sophisticated radiosurgery is so useful.

A fourth group of patients were treated with stereotactic radiosurgery without whole brain radiation

Equal responses to radiosurgery were seen despite different radiation doses used. Interesting enough, also no difference in response was detected based upon size of metastasis. One patient had an increase in headaches which responded well to steroids. In general patients tolerated their treatment well and remained as out-patients following administration of the treatment.

Radiosurgery has shown a dramatic success rate in controlling metastases. Since the brain is such a delicate organ encased in the bony skull, there is little room for increased pressure that metastatic tumors would produce.

Unfortunately, for those who have lost neurological function, it is not possible to guarantee improvement in actual function even if the tumor regresses. For that reason, it is practical to treat patients' metastases prior to causing significant impairment of function if the overall medical condition is stable. Occasionally, however, neurologic improvement sometimes occurs.

One reason to administer fractionated radiosurgery over single dose radiosurgery is, as noted by the authors, "Solitary lesions are frequently large and with stereotactic radiosurgery there is less relative sparing of the surrounding normal tissue. In this situation it would be at least theoretically of advantage to give fractionated treatment." Thus, fractionated treatment should further protect normal tissue while attempting eradication of the tumor.

The new removable stereotactic headframe also offers advantage of comfort as well as reproducibility. There are no screws that fix into the skull and therefore it is much more comfortable than the previously used headframe. It can be removed between the high resolution CT scan and actual administration of therapy so patients can go on with their normal activities. The depth confirmation helmet assures precision reproducibility of the relocatable headframe.

The benefits of stereotactic radiosurgery are clear - control of brain metastases for the vast majority while avoiding invasive surgery.

Our record using fractionated stereotactic radiosurgery allows the treatment of patients with single as well as multiple brain metastases. Comparison data shows improved survival in our patients treated with fractionated stereotactic radiosurgery compared to single fraction radiosurgery.

An additional appeal of the fractionation approach is the avoidance of pins in the head and the high dose radiation to the surrounding normal tissues. Fractionated stereotactic radiosurgery minimizes the untoward effects while maintaining - if not improving - the beneficial effects of this treatment.

Scores of procedures have been carried out using this fractionated approach. It is an attractive option for those with newly diagnosed as well as recurrent brain metastases. Fractionated stereotactic radiosurgery should improve the length of life and quality of life for patients with newly diagnosed brain metastases. For those with recurrent brain metastases - that is, brain metastases that are progressive, symptomatic or recurrent after standard therapy - fractionated stereotactic radiosurgery may offer an excellent treatment option.