Stereotactic Unit Expands Treatment Options for Patients with Brain Tumors

by Dawn Chalaire

Promising results achieved using stereotactic radiosurgery (SRS) and increased demand for the procedure have led to the opening of a new Stereotactic Unit at The University of Texas M. D. Anderson Cancer Center and to the development of stereotactic techniques that can be used to treat brain tumors that are not amenable to conventional SRS.

In contrast to standard radiation therapy, which is given in small, daily doses over a period of weeks, SRS delivers a high dose of radiation to a small volume of tumor in a single treatment.

"A higher degree of accuracy is required with stereotactic radiosurgery than with standard radiation therapy because the target is smaller and because you have only one opportunity to get it right."

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Associate Professor of Radiation Physics Almon Shiu, Ph.D., (right) and Moshe Maor, M.D., a professor in the Department of Radiation Oncology, examine the miniature multileaf collimator (MMLC) component of the Stereotactic Unit’s new linear accelerator. The MMLC, designed by Dr. Shiu, is used to deliver conformal stereotactic procedures.
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said Moshe Maor, M.D., a professor in the Department of Radiation Oncology and director of the new Stereotactic Unit.

The high, concentrated dose of radiation delivered in SRS is made possible by the precise convergence of beams of radiation to one focal point, the patient’s tumor. The radiation beams are delivered by a linear accelerator from different points along multiple arcs of rotation. The treatment couch also rotates 180 degrees, making possible many angles of rotation. The precision of SRS produces a sharp dose gradient between the target and surrounding area, allowing a much higher dose of radiation to the tumor with minimal damage to surrounding normal brain tissue.

“The full radiation dose falls to negligible levels within a few millimeters outside the target. Such precision cannot be achieved with any other method. Being able to deliver a high, concentrated dose to the tumor enables us to overcome the tendency of some tumors to resist radiation,” Dr. Maor said.

At M. D. Anderson, SRS is most commonly used to treat patients with 1 or 2 primary or metastatic brain tumors that are smaller than 4 cm in diameter and not surgically accessible. Studies of SRS show tumor regression in 70% of patients, Dr. Maor said, and in two-thirds of patients with brain metastases, neurological deterioration can be avoided.

M. D. Anderson has been performing SRS since 1991, but steadily increasing demand for the procedure over the past few years has led to the purchase of a new linear accelerator that will be used exclusively for SRS procedures. With the dedicated linear accelerator, more than one SRS treatment can be performed each day. The dedicated machine has the same capabilities as the department’s other linear accelerators, along with a more stable treatment couch and the ability to deliver intensity-modulated radiation therapy.

Dr. Maor said that collaboration with the Department of Neurosur-
Accuracy
Essential in
Stereotactic
Radiosurgery

Jim Lii holds a
magnifying glass
in front of one eye
and stares intently at the
image of a laser beam that
appears to be exactly in
the center of a pair of
tiny lines engraved on a
target that is mounted
on top of a mechanical
isocenter stand in a
radiation therapy treat­
ment room. He is not
satisfied.

"You see how the laser
beam is touching the
line?" Lii asks. "It should
do not be touching."

As Lii makes miniscule
adjustments to the wall-
mounted laser by remote
control, fellow medical
physicist Jin-Song Ye
explains that the beam is
between 0.10 and 0.20
mm from the isocenter,
well within the allowable
accuracy of 0.25 mm.

"But Jim is trying
to be exact," Ye says.

The two medical
physicists are performing
a quality assurance check
in preparation for a
stereotactic radiosurgery
procedure at The Univer­
sity of Texas M. D. Ander­
sion Cancer Center. They
have spent the morning
participating in the
acquisition of a patient’s
computed tomographic
images, performing
treatment planning on a
computer, and transfer­
ing the BRW coordinates
of the center of the
treatment target to a
metal frame known as
a rectilinear phantom
pointer (RLPP), which
serves as a model of the
patient’s head. The RLPP
is attached to a laser
target localizer frame and
to the treatment couch of
the linear accelerator. A
tungsten ball is placed
within the RLPP in the
exact location of the
center of the treatment
target within the patient’s
head, and film shots are
taken to verify its align­
ment. During SRS, all
the radiation beams will
crossfire through the
center of this point.

Lii and Ye spend
30-45 minutes applying
the same sub-millimeter
precision to checking
and double-checking the
positions of the RLPP,
the laser target localizer
frame, and the treat­
ment couch during the
patient’s treatment. They
even make adjustments
to allow for the weight
of the machine’s gantry
as it rotates around the
treatment couch, the
weight of the patient’s
head, and the ever-so-
slight tilt of the treatment
couch.

"Everything we do
here is for one purpose,”
Ye says. "We want to place
the center of the treatment
target, the patient’s tumor,
at the radiation isocenter
of the linear accelerator."

PROTOCOLS

Patients aged 16-75 years with newly
diagnosed single brain metastases who
are candidates for both conventional
surgical resection and stereotactic
radiosurgery (SRS) will be randomly
chosen to undergo surgery or SRS.
After the initial procedure, patients will
return for follow-up once a month for
the first two months and then every two
months thereafter. Patients must have
a life expectancy of at least four months,
be able to care for themselves, have
adequate bone marrow and platelet
function, and have no active, uncon­
trolled infection. Patients who require
immediate treatment to prevent neuro­
logical deterioration are not eligible for
this study. Evidence of leptomeningeal
disease, prior radiation therapy to the
brain, prior radioiodine treatment, and a
primary tumor that is extremely radio­
sensitive are all criteria for exclusion.

Patients who are pregnant or breast-
feeding are ineligible.

- A prospective randomized trial of
surgery with whole-brain radiation
therapy versus whole-brain radiation
therapy alone in the treatment of
multiple brain metastases (ID98-028).

Physician: Raymond Sawaya, M.D.

This phase III study includes both
inpatient and outpatient procedures for
patients with newly diagnosed multiple
brain metastases determined by MRI.
Patients will return for follow-up at one
month and two months after treatment
and every two months thereafter. To
participate, patients may have no more
than three lesions, and all lesions must
be resectable. A life expectancy of at
least four months is required, and
patients must be candidates for conven­
tional surgical resection. If a neurosur­
geon and radiation oncologist determine
that all of a patient’s brain tumors
necessitate surgical resection, the
patient is not eligible. Patients who have
an extremely radiosensitive primary
tumor, have received prior radiation
therapy to the brain or prior radioiodine,
have evidence of leptomeningeal
disease, or are pregnant or breast-
feeding are ineligible.

FOR MORE INFORMATION about these clinical
trials, physicians or patients may call
the M. D. Anderson Information Line.
Those within the United States should
call (800) 392-1611; those in Houston
or outside the United States should
call (713) 792-6161. Visit the M. D.
Anderson Cancer Center clinical trials
web site at http://www.clinicaltrials.org
for a broader listing of treatment research
protocols.
Patients with advanced cancer can experience many severe symptoms—pain, fatigue, chronic nausea, lack of appetite, and malnutrition—simultaneously. In addition, these patients and their families must cope with emotional distress and face what may seem like a never-ending parade of difficult decisions.

"The patient needs a combination of very well planned control of physical symptoms and emotional support, and the family needs to see that the patient is well treated, from both the physical and emotional points of view," said Eduardo Bruera, M.D., director of the newly established Symptom Control and Palliative Care Center at The University of Texas M. D. Anderson Cancer Center. "The family needs support and validation of their own fears and concerns. They also need to address some of the issues regarding the duration of the patient's life and anticipate and plan for the care that the patient will need."

Working in partnership with community physicians, the Symptom Control and Palliative Care Center provides multidisciplinary assessment and management strategies to control and alleviate the severe symptoms faced by patients with advanced cancer and offers support and counseling for family members.

"The goals of the center are to treat patients who have very advanced and incurable cancer," said Dr. Bruera, "and to help and empower all other centers and all other oncologists and practitioners in our area of influence to feel more comfortable with the assessment and treatment of these patients."

Most patients will be referred to the center, which officially opened the second week in October, by physicians at M. D. Anderson, Dr. Bruera said, although a small number may be referred by other physicians in the Houston area. Because most of the patients seen at the center are extremely weak and frequently have symptom distress, the center has private rooms with bathrooms and full-size beds. The center does not, however, have a waiting room; as soon as patients and family members arrive, they are taken to a private room where they are provided educational videos and computer programs to view between consultations. During their half-day stay at the center, patients are visited by a physician, nurse, pharmacist, physical therapist, occupational therapist, nutritionist, psychologist, pastoral care representative, and social worker.

"The representatives of each discipline offer their support, make an assessment, and meet together to discuss the strategy to be proposed to the patient and family. Then, a series of recommendations and suggestions are given to the patient and family and sent to the patient's primary care physician and community nurse," Dr. Bruera said.

All patients are provided with written, as well as verbal, recommendations and an audiocassette that summarizes the main recommendations so that the patients can share the information with their families. Some patients will require follow-up at the center, while other patients will be referred back to their primary care physicians. Patients who return to the center receive a two-hour assessment by a physician, nurse, and pharmacist. Two-hour assessments are also available for patients who do not require a half-day stay at the center. Patients visiting the center for

For more information, contact Dr. Maor at (713) 792-3410 or Dr. Shiu at (713) 792-3292.
Community Physicians Inc. Cancer

"The patient needs a combination of very well planned control of physical symptoms and emotional support, and the family needs to see that the patient is well treated."

- Eduardo Bruera, M.D., director, Symptom Control and Palliative Care Center

Before a treatment recommendation is made, patients with advanced cancer are evaluated by representatives from several disciplines in the Symptom Control and Palliative Care Center. Eduardo Bruera, M.D., center director, also conducts an initial interview of each patient who is referred to the outpatient center.

either half-day or two-hour assessments may receive treatments or undergo tests before being referred back to their primary care physicians.

A 13-bed, tertiary palliative care unit designed to stabilize patients with severe symptom distress is scheduled to open in the spring of 2000 on the same floor as the outpatient center, Dr. Bruera said. Once their symptoms are under control, patients will leave the unit and return to their local hospital or hospice or, occasionally, home.

"That will make for a very nicely integrated setting," Dr. Bruera said. "On the same floor, we will have the nursing staff, support staff, and facilities, as well as a common theme and integrated policies and procedures."

In addition to offering specific treatment strategies for individual patients, the Symptom Control and Palliative Care Center educates community physicians about caring for patients with advanced cancer through lectures, courses, and symposiums. A major palliative care conference is scheduled for June 2 and 3, 2000, and beginning in April 2000, the center plans to offer four-hour Internet courses for Continuing Medical Education credit. Information about the center’s educational offerings can be found on its home page at www.mdanderson.palliative.org.

"Contrary to other centers that mainly provide treatment, we see ourselves as having less of a direct treatment role and a major educational role," Dr. Bruera said.

Dr. Bruera and others in the center are also working to expand on the limited research available on the causes and treatments of many of the devastating symptoms associated with advanced cancer. Dr. Bruera, who came to M. D. Anderson in July 1999 after spending 15 years as a professor of oncology at the University of Alberta in Edmonton, Alberta, Canada, will continue his research in several areas related to palliative care.

"The questions that we are addressing in our research cover a broad spectrum," Dr. Bruera said. "They include: How can we prevent cachexia and fatigue? What is the best communication strategy? Which medications are the most effective? What models of health service delivery make access to care most effective? All of these questions are focused on treating patients with advanced cancer."

Incorporated into the new Symptom Control and Palliative Care Center are the Pain Research Group and the Physical Medicine and Rehabilitation Group. The Pain Research Group has contributed a body of work to the new center that includes studies of the best ways to assess pain and other symptoms. The Physical Medicine and Rehabilitation Group helps all patients with cancer, including those whose cancers are incurable, express their maximum physical and psychosocial function and assists patients who have undergone successful aggressive cancer treatments in returning to a productive and effective life.

For more information, contact Dr. Bruera at (713) 792-6085.
Cigarette smokers and users of smokeless tobacco now have yet another incentive to break the habit. Under new Internal Revenue Service guidelines, the cost of tobacco cessation programs and associated prescription medications can be claimed as income tax deductions. These items are now considered “Deductible Medical Expenses” and can be itemized under this category on the yearly income tax statement.

Allowable deductions include expenses for prescription medications such as antidepressants, which are often included in tobacco cessation regimens; tobacco cessation programs; and physician’s fees. However, non-prescription smoking cessation aids such as nicotine patches and gum are not deductible.

“We hope this endorsement at the federal level will spur insurance companies and managed care companies to offer coverage for tobacco cessation programs,” commented Bernard Levin, M.D., vice president for cancer prevention at The University of Texas M.D. Anderson Cancer Center.

Dr. Paul Cinciripini, Ph.D., director of tobacco research and treatment at M. D. Anderson, said that the tax deductions are a small step in the right direction.

“This will help some people receive reimbursement for important prevention services,” Dr. Cinciripini said, “but far more should be done to address the need for insurance coverage of tobacco cessation programs.”

An example of an allowable deduction is the service provided through M. D. Anderson’s Tobacco Cessation Clinic. At the clinic, patients receive individualized counseling in a six- to eight-week program that costs about what most pack-a-day smokers spend on cigarettes in six months.

“We’re very glad to see such a broad-brush incentive,” said Therese Bevers, M.D., medical director of M. D. Anderson’s Cancer Prevention Center, home to the Tobacco Cessation Clinic. “This may be just the right form of encouragement to help many tobacco users kick the habit.”

For more information about M. D. Anderson’s Tobacco Cessation Clinic, call (713) 745-8040 or (800) 438-6434.
Our mother was right: Fruits and vegetables are good for you. In fact, there is overwhelming evidence that eating fruits and vegetables can help decrease your risk of developing certain cancers.

While it is clear that diets that include a wide variety of fruits and vegetables protect against several types of cancers, determining which constituents of fruits and vegetables are responsible for the decreased risk is more difficult.

**Vitamin C.** There is convincing evidence that vitamin C decreases the risk of developing cancers of the larynx, esophagus, stomach, and pancreas, according to an analysis of studies of vitamin C published in *Nutrition and Cancer Prevention*. In addition, the authors concluded that dietary vitamin C possibly decreased the risk of lung cancer in non-smokers and the risk of cancers of the oral cavity, rectum, and cervix.

Eating foods high in vitamin C seems to have a more beneficial effect than taking vitamin C supplements, probably because there are additional cancer-protective agents in vitamin C-rich foods. Good sources of vitamin C include citrus fruits, broccoli, cabbage and other green leafy vegetables, peppers, tomatoes, potatoes, mangoes, strawberries, and melons.

**Vitamin A.** The American Cancer Society recommends eating a lot of fruits and vegetables that are rich in vitamins A and C for possible protection against cancers of the throat, stomach, and lungs and some skin cancers. Foods high in vitamin A include apricots, cantaloupe, carrots, romaine lettuce, mangoes, mustard greens, pumpkin, spinach, sweet potatoes, and winter squash.

**Carotenoids.** Researchers have also been investigating the cancer-reducing effects of carotenoids, chemicals that are synthesized by plants. Diets high in carotenoids probably decrease the risk of lung cancer and also may decrease the risk of esophageal, stomach, colorectal, breast, and cervical cancers, according to the American Institute for Cancer Research’s *Food, Nutrition, and the Prevention of Cancer: A Global Perspective*.

Beta-carotene is a carotenoid that is found mainly in yellow-orange vegetables and fruits and in dark green, leafy vegetables. Other carotenoids are found in tomatoes, watermelon, pink grapefruit, pumpkin, grapes, eggplant, and some berries.

**Vitamin E.** An American Institute for Cancer Research panel also found that diets high in vitamin E possibly decrease the risk of lung and cervical cancers. Vitamin E is found in vegetable oils, whole grains, nuts, seeds, and wheat germ.

**Antioxidants.** Vitamins C and E, beta-carotene, other carotenoids, and the trace mineral selenium have antioxidant properties. Antioxidants, scientists theorize, neutralize potentially destructive reactive molecules called free radicals before they can attack DNA. By halting free radical assault, antioxidants may stop genetic mutations and thereby reduce the risk of certain cancers.

**How much is enough?** For cancer prevention, eating a diet rich in fruits and vegetables is preferable to swallowing vitamin supplements because other components of fruits and vegetables may also contribute to cancer prevention. Taking megadoses of a particular vitamin over an extended period of time may also be harmful.

The National Cancer Institute advises eating five or more servings of fruits and vegetables a day. One medium piece of fruit or 1/2 cup of fresh fruit, 3/4 cup of 100% fruit or vegetable juice, 1/4 cup of dried fruit, 1/2 cup of raw or cooked vegetables, and 1 cup of leafy vegetables each count as a single serving.

Surveys show that most people already eat an average of two to three daily servings of fruits and vegetables. Adding an extra two or three servings a day can be as simple as eating a banana at breakfast, snacking on an orange, and having an extra serving of vegetables with dinner.

The good news is that you can improve your eating habits at any age. Whenever you start, you’ll begin to be healthier and reduce your cancer risk.

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For more information, contact your physician or contact the M. D. Anderson Information Line:

(800) 392-1611 within the United States, or

(713) 792-6161 outside the United States.

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