The care that AT received from the neurotrauma team has many components. Modern progress in the field of head trauma was first attained when a common language for describing the extent of injury, developed in Glasgow Scotland in 1976, became widely accepted. With this tool it was, for the first time, possible to begin to categorize the types of injuries being treated and thereby begin the long path toward making progress in this area. The Glasgow Coma Score (GCS) also proved to be a good prognostic tool, which proved useful in helping families of trauma victims understand the implications of the injury their loved one had sustained.

Clinical care was initially guided by the continuous monitoring of intracranial pressure (ICP) recorded from catheters placed within the fluid spaces of the brain via a small hole in the skull. AT’s pressure was moderately elevated. Because an elevated ICP has proven to be prognostic of a poorer outcome, efforts were focused upon getting this number in a normal range.

A major benefit of ICP monitoring was its ability to provide immediate awareness of new swelling or bleeding within the skull, an event that without monitoring could only be noticed clinically when severe swelling caused compression of the brain stem and the cranial nerves. Thus, monitoring provided an earlier awareness of a potentially life threatening problem. The same catheter was also useful for “venting” cerebrospinal fluid that frequently built up within the fluid spaces, due to blood within the spinal fluid, further elevating ICP and compromising cerebral blood flow. AT was initially treated with moderate hyperventilation and drainage of ventricular fluid with the ICP staying slightly elevated.

Despite the proven utility of ICP monitoring, the goal has always been to directly measure the adequacy of the blood supply. One measure of the blood supply is whether it was supplying adequate nutrients to prevent secondary brain injury. Oxygen is one of those essential nutrients. Oxygen availability within the brain tissue was continuously monitored in AT by a second probe inserted near the ventriculostomy.

High levels of tissue oxygen implies adequate levels of blood flow while reduced levels can be due to compromised perfusion, or a problem with oxygen delivery to the blood stream due to a pulmonary injury. A fall of the tissue oxygen level below a critical threshold may not always be due to the same cause, but it always provides early warning that there is a problem that needs to be addressed. The problem with such a probe is that the information is very focal and may not reflect changes elsewhere in the brain. Oxygen availability for the entire brain is also

(See What can we learn on page 5)
Mid-year review points to bright, prosperous future

At the end of the first half of the academic and fiscal year, we can make a few predictions and a few projections. Our mission of patient care, research, and education continues to prosper.

For the first time, we were able to segregate our neurosurgical national NIH funding. As noted in our last edition, basic science and clinical research are extraordinarily important missions of our department. We were pleased to note that the University of Pittsburgh is ranked as number two in the United States for NIH research based on a survey released by residentphysician.com. Our total research funding in addition includes a center grant from the Centers For Disease Control, and significant industry funding as well as support from the Walter Copeland Fund of the Pittsburgh Foundation. In aggregate, our funding on an annual basis exceeds $7 million. We finished second behind the University of California at San Francisco in NIH funding. For the first time, we may be able to track on an annual basis comparative funding among academic neurosurgery departments across the United States. I would like to congratulate our entire pool of faculty and support staff for their critical efforts in achievement of this very important goal. Without the excitement of science, supported by the infrastructure of the department and assisted by resources in the School of Medicine and the University of Pittsburgh Office of Research, we could never be so successful.

In addition, our clinical productivity at mid-year continues to show enormous growth. Our growth rate is 15.1% estimated for the 2004 fiscal year, with a 20% increase in work RVU’s from fiscal year 2003 to 2004. As we track surgical productivity for both major and minor cases, at mid-year, 3,395 procedures were performed, suggesting that clinical volume by the end of the fiscal year will approach 8,000 surgical procedures. Currently, we do this with 21 neurosurgeons.

At present, we are seeking the services of a dedicated academic trauma neurosurgeon. In addition, as we expand services for image-guided neurosurgery and stereotactic gamma knife radiosurgery, we are pleased that Dr. Ajay Niranj will join our clinical faculty providers of gamma knife radiosurgery in July 2004. Hideho Okada, MD, PhD will also join our clinical provider team with a special focus in medical and surgical research neuro- oncology. Dr. Okada is directing innovative clinical trials for the management of brain tumors.

Neurosurgery continues to push the frontier of innovation. Among our efforts are provision of minimally invasive, endoscopic-assisted resection of complex skull base tumors, pioneering efforts in endovascular surgery, and care of pediatric, epilepsy and movement disorder patients. The third Leksell Gamma Knife Model C Unit will become operational in pristine renovated space approximately May 1, 2004. We hope to be able to complete the acquisition of a magnetoencephalography (MEG) Unit to assist in and possibly expedite the evaluation of patients with brain tumors (cortical mapping), trauma, and cognitive disorders, stroke recovery, and epilepsy evaluations. This unit will be housed on clinical space on the first floor of UPMC-Presbyterian.

In all, this summary year-to-date projects a bright future and predicts another successful academic year. Our educational efforts have been supplemented by the excellent visiting professorships of Drs. Jeff Manley, Roberto Heros, Kevin Foley, and Kalmon Post.

L. Dade Lunsford
Lars Leksell Professor
Chairman, Department of Neurological Surgery

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New polymer film may remove painful scar tissue in spine surgery patients

by Peter Gerszten, MD, MPH
Assistant Professor of Neurosurgery

William Welch, MD
Director, Spine Services Division

More than 250,000 patients undergo lumbar disc surgery in the United States each year. Recurrent radiculopathy is reported to occur in up to 40% of patients who have undergone surgical treatment for primary lumbosacral disc herniation. One in eight patients undergo a second lumbar procedure. One in four patients undergoing lumbar disectomy never return to their original occupation. One in ten patients—an estimated 25,000 to 50,000 patients annually—are permanently disabled and unable to return to the workforce.

Postoperative peridural fibrosis is a common occurrence after lumbar spine surgery. Fibrosis can cause compression or tethering of the nerve root and has been implicated as one of the factors that contribute to recurrent radicular and/or low back pain after a successful lumbar disectomy. Fibrosis may be the underlying cause in as many as 24% of all cases of failed back surgery syndrome (FBSS). Re-operation with the intention of excising this fibrous tissue and releasing or decompressing the symptomatic nerve root often produces a poor surgical result and further scarring. Less than one third of the patients re-operated after lumbar disc surgery show persistent improvement of their symptoms. The likelihood of long-term success after re-operation when peridural fibrosis is the cause of FBSS is even less. There is currently no consistently effective medical or surgical therapy for peridural fibrosis.

Many materials have been studied in animal models as barriers to post-laminectomy scar formation. The common assumption among these studies is that interposing materials would prevent adhesion between the dura mater and the scar tissue by preventing fibroblast migration. These materials demonstrated only moderate effect in animal models on the reduction of postoperative peridural fibrosis. Initial human studies of the semi-synthetic polyglycan ADCON-L were promising, but large prospective randomized trials failed to demonstrate any benefit.

Hydrosorb Shield® from MacroPore Biosurgery, Inc. of San Diego, CA is a resorbable polymer barrier film fabricated of poly (L-lactide-co-D,L-Lactide) (PLA) sterilized by electron-beam irradiation. Hydrosorb has been studied extensively in ovine, and canine models as a successful barrier to peridural fibrosis when placed directly over the lumbar nerve root and for the reduction of pericardial adhesions in a swine model. An identical PLA product with a different trade name—Surgi-Wrap™ also from MacroPore—is currently used in a variety of human surgical applications, including as a barrier to sternal-myocardial adhesions after open heart surgery and abdominal adhesions.

A current outcomes study conducted by our department and Joseph T. King, Jr., MD, MSCE from Yale Medical Center looks at how Hydrosorb may improve pain, functioning and quality of life in patients who undergo spine surgery to remove painful scar tissue. For this study, patients with symptomatic lumbar epidural fibrosis who are undergoing surgical nerve root decompression will have Hydrosorb placed directly over the decompressed nerve root to impede the adhesion of post-operative scar tissue. The investigators will evaluate the outcomes of patients with symptomatic post-discectomy peridural scar formation who undergo surgical nerve root decompression supplemented with Hydrosorb to reduce post-operative scar adhesion.

For more information, please contact our office at (412) 647-1700.
Survey examines radiosurgery, radiotherapy for brain metastases: 
The Patients’ Perspective About Side Effects

by Douglas Kondziolka, MD
Co-Director, Center for Image-Guide Neurosurgery

Brain metastases are the most common type of intracranial tumors. Conservative estimates suggest that 100,000 to 170,000 new cases of solitary brain metastases are diagnosed every year in the United States. Many additional patients develop multiple brain tumors. Historically, treatment options for patients with these tumors included medical management with corticosteroids and whole brain radiation therapy (WBRT) in most, and surgical resection in a few. Patients with brain metastases also often have active systemic disease. In recent years radiosurgery has emerged as an effective, minimally invasive option for patients with brain metastases. Although we have good information regarding the tumor response and survival, information on quality of life from the patients perspective is lacking.

We surveyed 200 consecutive patients with brain metastases treated with Gamma Knife radiosurgery. The survey was sent to patients prior to the issuing of rules related to HIPAA legislation. The survey consisted of ten questions directed at the patients or their family. We asked for their perception regarding treatment (WBRT and/or radiosurgery), side effects (hair loss, fatigue, problems with short-term memory, excess fatigue, problems with long-term memory, problems with mood (depression), concentration (61%) and depression (54%) were reported major side effects of WBRT (p < .001). Major reported side effects of WBRT included hair loss (88%), excess fatigue (85%), problems with short-term memory (83%), long-term memory (33%), concentration (61%) and depression (54%) (see table 1 below). One responder each also noted impaired taste, incontinence, tremors, hot flashes, bleeding, minor headache, diminished hearing, irritability, speech problems, loss of words, hemiparesis, cataracts, worsened eye sight, dry nasal passages, and dizziness (see table 2 below). Fatigue was reported in 5% of radiosurgery only patients (p=.001). Seventy-six percent of respondents considered radiosurgery a good treatment while only 57% considered WBRT a good treatment for them (p=.25). Only 24% of the patients were employed at the time of the treatment and only 14% remained employed. Some patients (18%) thought that WBRT delayed other cancer treatments that they would have preferred to undergo (see Study on page 8).

### Table 1
Reported Major Side Effects of WBRT  
(n=72 patients)

<table>
<thead>
<tr>
<th>Side Effect</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hair loss</td>
<td>63</td>
<td>88</td>
</tr>
<tr>
<td>Excess fatigue</td>
<td>61</td>
<td>85</td>
</tr>
<tr>
<td>Problems with short-term memory</td>
<td>52</td>
<td>72</td>
</tr>
<tr>
<td>Problems with long-term memory</td>
<td>24</td>
<td>33</td>
</tr>
<tr>
<td>Problems with concentration</td>
<td>44</td>
<td>61</td>
</tr>
<tr>
<td>Problems with mood (depression)</td>
<td>39</td>
<td>54</td>
</tr>
</tbody>
</table>

### Table 2
Other Side Effects of WBRT  
(n=72 patients)

<table>
<thead>
<tr>
<th>Side Effect</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imbalance</td>
<td>9</td>
<td>12.5</td>
</tr>
<tr>
<td>Loss of Appetite</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Nausea/Vomiting</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Weakness</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Confusion</td>
<td>4</td>
<td>5.5</td>
</tr>
<tr>
<td>Altered Smell Sense</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Seizures</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Forehead Burning/Tenderness</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Swelling</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

### Table 3
Reported Side Effects after Radiosurgery  
(n=104 patients)

<table>
<thead>
<tr>
<th>Side Effect</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imbalance</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Fatigue</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Neurological deterioration</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Short term memory problems</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Mild headache 5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Seizures</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Vomiting 5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Lack of concentration</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Transient swelling at pin site</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Confusion</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
monitored by placing a catheter within the major vein draining the brain. Jugular bulb monitoring has proven to be a safe and effective means of understanding the extent of oxygen extraction for the entire brain obtained by measuring the difference between the arterial blood gas and the venous blood gas. When the difference between these values is small, it provides support that the delivery of blood is far greater to the brain than required. These oxygen studies provided further support that AT did not need more blood flow despite the persistent elevation of ICP.

Brain blood flow can also be monitored providing an additional understanding of the brain injury. Today we have three additional approaches to understanding if the blood supply to the brain is adequate. Transcranial Doppler (TCD) is a minimally invasive method to measure the blood flow velocity in the middle cerebral artery from which the brain perfusion is computed. While this method cannot provide quantitative data on cerebral blood flow (CBF) it can provide a noninvasive means of following trends of large vessel blood flow. Similar to oxygen monitoring, a new tissue CBF probe has the advantage of providing a continuous recording of focal tissue blood flow, but the disadvantage of only doing it in a very small portion of the brain. This tool is proving useful for monitoring the benefit of various interventions designed to improve CBF. The third method for CBF assessment involves Xenon enhanced CT scans that provide high resolution tomographic flow information with direct anatomic correlation. The disadvantage of this type of information is that it requires movement of the patient to the CT department but severely injured patients frequently require CT imaging to provide an understanding of possible changes in brain anatomy. Modern CT scanners also provide access to high resolution pictures of the extra and intracranial vasculature (CT angiography), which is also commonly injured in head trauma victims.

A Xenon/CT CBF study in AT was very useful because, despite an elevation of ICP, flow levels in all regions were well above the ischemic threshold. This information was in agreement with the oxygen tissue monitor thereby providing the insight that more aggressive hyperventilation was likely to still be beneficial, while placing the patient in a deep chemical sleep (barbiturate coma) or removal of a large portion of the side of the head (cranial decompression) was not then indicated. AT was simply maintained with more aggressive hyperventilation combined with hypertonic saline infusion (3%) as a means of minimizing brain swelling.

After a week of care in the neurotrauma ICU, AT’s intracranial pressure began to return toward normal and the movement of her extremities steadily improved from posturing (extensor hand and arm movements) typical of a deep brain stem injury to those more consistent with a higher subcortical injury. AT had suffered an injury due to tearing of deep white matter tracts (diffuse axonal injury) which although capable of causing severe deficits often shows very little on current imaging studies. Early in AT’s care these monitors were able to tell us what she could not. The intracranial pressure, the oxygen tension and extraction and the cerebral blood flow in unity help us to optimize support and therapy to prevent secondary brain injury. These new technologies give us some insight into the pathophysiology after traumatic brain injury but they also raise more questions than they can answer right now.

It remains a challenge to provide optimal and intensive—but also humane and dignified—care to our patient in order to give them back their lives, ideas and thoughts.
Honoring the neurosurgeon with a smile

(Editor's note: The following article appeared in the winter 2004 edition of Pitt Magazine. It is reprinted with permission.)

by Mike Ransdell

Peter Sheptak stands shoulder to shoulder with one of his “hotshot” residents in the operating room at UPMC Presbyterian. An anesthetized patient lies on his side before them with an incision in his back. As a clinical professor at the University of Pittsburgh’s Department of Neurological Surgery, it’s part of Sheptak’s responsibility to sculpt the next generation of neurosurgeons.

“You just tell me when you think you got everything out,” he tells his young protege, who’s busy repairing the patient’s herniated lumbar disk.

Sheptak watches as the resident skillfully removes the damaged tissue and hands it to the nurse. When the resident’s gaze returns to the patient, Sheptak motions to the nurse with a slight tilt of his head and eyes. She knows what he wants her to do, having worked with him many times. She gives him the removed tissue and he conceals it in his latex-gloved hands.

“Okay, this is cleaned up. I really cleaned this guy out,” says the resident. “There’s the nerve. It looks great.”

The elder doctor leans in to examine the work, his hands cupped together across his chest as if concealing his cards in a game of high-stakes poker.

“Look what I found,” he says as he straightens and opens his hands to reveal the discovered tissue.

“What?” the resident stammers, shocked at what he’s seeing. “But...”

Sheptak smiles; the resident figures out what just happened.

Levity in the operating room like this, which happened several years ago, is an excellent way to keep residents on their toes and reduce stress, says Sheptak. The work that he and his colleagues do is gravely serious. Many operations require them to waltz delicately and dangerously close to the brain and spinal cord nerves. A slight slip of the hand removing a skull base tumor, for example, can have devastating and lasting results. So any opportunity to ease the tension, however brief, is a welcome relief and a must for a neurosurgeon’s state of mind, explains Sheptak. “If you don’t have a sense of humor, you’ll go crazy. It’s easy to get depressed taking care of sick patients a lot.”

Today, Sheptak, who is the department’s vice chair, estimates that he has cared for some 14,000 patients during his 35-year career as a surgeon. To acknowledge the doctor who touched so many lives, the University of Pittsburgh has created the Peter E. Sheptak Endowed Chair in Neurological Surgery. The chair will benefit a promising faculty member in the department.

Sheptak, from Butler, PA, graduated from the University of Pittsburgh’s School of Medicine in 1963 and has been associated with the Department of Neurological Surgery since 1968, training residents and treating patients. He also has been the Pittsburgh Penguins team neurosurgeon since the early 1970s and operated on some of the teams players, including its biggest star, Mario Lemieux. In fact, one wall in his fourth floor office at Presbyterian features framed photos of Sheptak standing with Penguins players next to the Stanley Cup. Most of the photos include handwritten notes from the hockey players with messages like Thanks, Doc.

Although he retired from surgery last year, his legacy lives on in the approximately 100 residents whom he has helped train; eight of whom, he estimates, are now heads of neurosurgical departments around the country.

Along with the skill to safely navigate through the sometimes tumultuous waves of neurological surgery, he hopes his students have learned how to connect with patients, to sit with them and listen, to make them feel as if they are the most important patient. And when the going gets tough—and he says it frequently does—he believes he taught his students what they need to do: smile.
Department Near Top In NIH Funding

The Department of Neurological Surgery at the University of Pittsburgh ranked second in the nation in funding for neurosurgery departments from the National Institutes of Health (NIH) according to a recent survey. The survey, published on the residentphysician.com website, includes data from 2002 and lists the University of Pittsburgh department with $5,756,056 in funding received in 15 grants. Only the University of California at San Francisco received more grants or total money in the nation, according to the survey.

With over 30 faculty and investigators, our department has remained a world leader in various aspects of neurosurgical research and development. The department, and the University of Pittsburgh as a whole, have been leaders in the area of multi-center trials which continue to be and remain the gold standard for answering clinical questions.

“Research has been and will be a major component of our mission as we provide care and try to drive future neurosurgical innovation,” said L. Dade Lunsford, MD, Lars Leksell professor and department chairman. “In addition, Department of Neurosurgery faculty also have funded grant projects from the Centers for Disease Control and Prevention, private foundations and industry. Taken as a whole, this places the department at the forefront of neurological research in this country.”

The NIH is an agency of the Department of Health and Human Services and is considered the steward of medical and behavioral research for the United States.

New Research Grants

- “Gene Expression in Brain Tumor Angiogenesis,” Kevin A. Walter, MD, National Institute of Neurological Disorders and Stroke (NINDS) ($675,000).
- “Hypothermia for Severe TBI in Children,” P. David Adelson, MD, NINDS ($205,780).
- “Protein Kinase B & C in Head Injury,” Larry Jenkins, PhD, NINDS ($1,373,913).
- “Myocardial Ischemia and Vasospasm in Aneurysmal SAH,” Michael Horowitz, MD, NIH-RO1 Grant (Four-year study), National Heart and Lung Institute ($2,134,857).

Media

Mark R. McLaughlin, MD, a 1999 graduate of the department’s residency program, was featured in a recent edition of Parade magazine. The article described Dr. McLaughlin’s efforts to bring modern neurosurgery techniques to Russia.

Dr. Horowitz received prominent attention in both local and national media for using a human cadaver arm in a lecture at a local fifth grade science class. The arm was utilized to help further illustrate studies the students had recently completed in how body systems interrelate. Dr. Horowitz has volunteered numerous times to help educate elementary school age children. He was surprised at the media attention regarding the arm since he had brought eyes, ears and a brain in previous visits to the school, without notice.

Promotions

- Amin Kassam, MD, was promoted to associate professor.

Announcements

- Dr. Walter was appointed to the executive committee of the Neurosurgical Research and Education Foundation of the AANS.
- A. Leland Albright, MD, was a visiting professor at the University of Toronto, March 25-26 and at the University of Calgary, April 22-23. Dr. Albright also gave the Donald Matson Memorial Lecture at the American Association of Neurological Surgeons (AANS) annual meeting.
- Douglas Kondziolka, MD, was a visiting professor at Brigham & Women’s Hospital/Children’s Hospital in Boston, MA, February 11-12.
- Dr. Adelson, was elected chairman of the Joint Section on Neurotrauma and Critical Care of the AANS.

Welcome

Karen Karkalla, medical transcriptionist; Francis Dreher, medical records assistant; Melissa Hawthorne, administrative secretary for Drs. Kassam and Horowitz; Jessica Hampton, research assistant for Dr. Walter; Tammy Capozzoli, Center for Skull Base Surgery coordinator; Judy Sestili, administrative assistant to Ian Pollack, MD.

Teresa O’Conner, Tri-State Neurosurgical Associates RN; Richard Sigler, Tri-State RN; Marcy Sunday, RN for Adnan Abla, MD; Angela Ullom, Tri-State office assistant; Erika Wright, RN for Matt El-Kadi, MD, PhD; Judy Cooney, RN for Ghassan Bejjani, MD; Diane Moses, Tri-State medical records coordinator.

Junichi Eguchi, MD, and Fumihiko Nishimura, MD, both postdoctoral associates working with Hideho Okada, MD, PhD.

Congratulations

- Dr. Walter completed the Walt Disney World Marathon in Orlando, FL on January 11, in 4 hours, 17 minutes and 9 seconds. The course took runners through all four of the resort’s theme parks with a finish in EPCOT Center.
- New baby girl (Marisa Marie, January 22) to Ed Shaffer, physician assistant, and wife Gina; new baby boy (Nicholas Thomas, February 5) to Matthew Wetzel, MD, and wife Fotini; new baby boy (Michael Gerald, April 7) to Cyndi Miklos Bonkoski, appointment secretary, and husband Jerry.

Upcoming Events

- May 24-29: Principles and Practice of Gamma Knife Radiosurgery. Training course targeted at neurosurgeons, radiation oncologists and medical physicists interested in Gamma Knife radiosurgery education. For more information, contact Charlene Baker at (412) 647-6250.
- June 4-5: Minimally Invasive Endoscopic Surgery of the Cranial Base and Pituitary Fossa Course. Series of lectures on approaches for endoscopic surgery of the cranial base and pituitary fossa. Minimally invasive techniques will be discussed as well as interactive live cases discussed. For more information, please contact Greta Seever at (412) 647-0403.
Study examines patients’ perspective on radiosurgery, radiotherapy side effects

(continued from page 4) received. The reported main side effects after radiosurgery are listed in table 3. Other effects noted by single responders included oral ulcer, tremors, constipation, depression, severe headache, brief episodic visual impairment, cataracts, loss of appetite, and weight loss.

With an understanding of both the medical and economic effects of radiosurgery, these treatments can be used in different ways for brain metastasis management. First, patients with small solitary tumors with good neurologic functional status and stable extracranial systemic disease may be managed with radiosurgery alone or radiosurgery combined with whole-brain irradiation. Specifically, patients with relatively radiosensitive tumors such as melanoma or renal cell carcinoma may derive little benefit from conventional radiation therapy compared to radiosurgery. In these patients, the resultant hair loss and possible late effects on cognitive function after whole-brain irradiation might be avoided if radiosurgery alone is used. Surgical resection mainly is used in patients with larger tumors who have neurological symptoms not well treated with corticosteroids. The most important reason for surgical resection is the brain metastasis patient with a large (>3 cm diameter) brain tumor with symptomatic mass effect. In such patients the degree of parenchymal edema and mass effect usually is so great that more rapid improvement is desired. Since progression of extracranial disease is the most important limiting factor for survival, we think it important that patients not avoid treatment for extracranial cancer due to a delay caused by brain tumor management.

We believe it is time to re-evaluate the general use of whole brain irradiation for all patients with brain metastasis in light of several factors. Several randomized, multi-center trials have shown that whole-brain irradiation alone provides only modest benefit for most patients, and thus more effective treatment might be used for patients with solitary tumors. Our ability to detect small, asymptomatic metastases with high-resolution imaging may now help to identify a patient subgroup for whom longer survival and enhanced neurologic function would be expected. Improvements in systemic care may also lead to longer survivals.

The documented late effects of whole-brain irradiation appear to be avoided with a more focused radiation approach. Since radiosurgery can be used for patients who develop new remote tumors (without overlapping prior radiosurgery volumes), repeat radiosurgery can be an additional important strategy. Two current clinical trials sponsored by the American College of Surgeons Oncology Group (Z0300) and EORTC 22952 are underway to study the value of radiotherapy in addition to radiosurgery.