Addressing Emerging Survivorship Issues in Glioblastoma Patients

By Joe Munch

An increasing number of glioblastoma patients are becoming “long-term” survivors—living 3 or more years after diagnosis.

But this small success is bittersweet: these patients’ prolonged survival can be marred by the lasting effects of the tumor and its treatments. As the concept of survivorship in this population emerges, researchers are working to identify and address the issues facing glioblastoma patients during and after treatment.

By the numbers

Since the U.S. Food and Drug Administration’s approval of temozolomide for the treatment of adult patients with newly diagnosed glioblastoma in 2005, the 2-year survival rate of glioblastoma patients has doubled, from 12% to about 25%.

“Ten years ago, people were not talking about brain tumor survivorship issues,” said John de Groot, M.D., an associate professor in the Department of Neuro-Oncology at The University of Texas MD Anderson Cancer Center. “But this new standard of care seems to have shifted the bar.”

Despite this progress, nearly 100% of glioblastomas recur, usually within 6–8 months. The median survival duration of glioblastoma patients is 16–19 months; their 5-year survival rate is around 10%.

“There’s a sense of futility if you read the numbers. But statistics are just statistics; they mean nothing for the individual patient,” Terri Armstrong, Ph.D., a professor and an advanced practice nurse in the Department of Neuro-Oncology, said. “Our approach to every glioblastoma patient is to control the tumor for as long as we can. It’s something the person is going to be dealing with for the rest of his or her life, and our goal is to maximize the patient’s treatment options and ability to function during that time.”

Lasting tumor effects

Symptoms of glioblastoma, the most common type of brain cancer, include headaches, seizures, changes in personality, and focal weakness on one side of the body. Many glioblastoma patients also experience tumor-induced cognitive deficits—
Survivorship Issues in Glioblastoma Patients

[Continued from page 1]

primarily memory loss and loss of executive function—that may persist or worsen through therapy. Glioblastoma patients also experience mood disorders and personality changes at rates that are substantially higher than those of the general population of cancer patients.

“This disease ravages the organ that supports our ability to think, our personality, and our ability to modulate our emotions and behavior—all of which define who we are and determine how we navigate our world,” said Jeffrey Wefel, Ph.D., an associate professor in the Department of Neuro-Oncology.

As with any brain tumor, the symptoms of glioblastoma—especially cognitive deficits—depend largely on the location of the tumor. Problems with executive function, for example, are more common in patients with tumors in the frontal lobe. Cognitive processes that rely on widely distributed neural networks, such as learning and memory, are affected by tumors in various locations.

The deficits created by glioblastoma can sometimes be permanent because the tumor destroys a portion of the brain. The technology to rebuild portions of the brain is not yet available for clinical use, and researchers are still working to develop treatments that will harness the brain’s neuroplasticity to rebuild function in neighboring areas. As a result, glioblastomas are often treated much like a neurodegenerative condition: cognitive interventions focus on the patient’s residual strengths and use a variety of cognitive prosthetics—assistive technologies designed to help improve the patient’s daily function—to minimize the impact of the cognitive deficit.

“Oftentimes, we do not expect to see a dramatic restoration of the impaired cognitive process, but we help patients compensate so they can maintain as much independence as possible for as long as possible to help them...”

A magnetic resonance image shows a glioblastoma in the right frontal-occipital lobe. Tumors in this region can be associated with weakness on the right side of the body, sensory neglect, difficulty with visual-spatial relations, and seizures.

CLINICAL TRIALS: Brain Tumors


Principal investigator (PI): Jeffrey Wefel, Ph.D. The goal of this study is to learn if brain tumor patients can complete an at-home computerized rehabilitation program that may help treat problems with attention and memory.

Phase I trial of conditionally replication-competent adenovirus (Delta-24-RGD) for recurrent malignant gliomas (ID01-310). PI: Frederick Lang, M.D. The main goal of this study is to find the highest tolerable dose of Delta-24-RGD-4C (the RGD-4C peptide motif enhances binding to cancer cells) that can be injected directly into brain tumors and into the surrounding brain tissue where tumor cells can multiply. A secondary goal is to study how Delta-24-RGD-4C affects brain tumor cells and the body in general.

A randomized phase I/II study of ABT-888 in combination with temozolomide in recurrent (temozolomide-resistant) glioblastoma (RTOG0929). PI: John de Groot, M.D. The goals of this study are to find the highest tolerable dose of the combination of the poly(ADP-ribose) polymerase inhibitor ABT-888 and temozolomide that can be given to patients with glioblastoma and to learn if the combination of temozolomide and ABT-888 can help control glioblastoma. Two dose schedules of the study drug combination will be compared.

Randomized phase II trial of standard-dose bevacizumab versus low-dose bevacizumab plus lomustine (CCNU) in adults with recurrent glioblastoma multiforme (2009-0597). PI: Dr. de Groot. The goal of this study is to learn if the combination of bevacizumab and lomustine can help to control glioblastoma.

Randomized, double-blind, placebo-controlled trial of lacosamide for seizure prophylaxis in patients with high-grade gliomas (BTTC11-01). PI: Mark Gilbert, M.D. The primary goal of this study is to determine whether lacosamide will reduce the risk of seizures in patients with high-grade glioma.

Phase I/II adaptive randomized trial of bevacizumab versus bevacizumab plus vorinostat in adults with recurrent glioblastoma (BTTC11-02). PI: Marta Penas-Prado, M.D. The goal of this study is to compare the efficacy of bevacizumab plus vorinostat to that of bevacizumab alone for controlling malignant gliomas. The safety of these drug regimens will also be studied.

A phase I lead-in to a 2×2 factorial trial of temozolomide, memantine, melfoquine, and metformin as post-radiation adjuvant therapy of glioblastoma multiforme (2011-0374). PI: Dr. Penas-Prado. The aim of this study is to find the highest tolerable dose of temozolomide in combination with memantine, melfoquine, and/or metformin that can be given to patients with glioblastoma who have already been given combined radiation therapy and chemotherapy.

FOR MORE INFORMATION
encompass or maintain their quality of life," Dr. Wefel said.

Dr. Wefel is the interim chief of MD Anderson's Neuropsychology Section, a team of neuropsychologists who provide care and recommendations alongside neurosurgeons, radiation oncologists, and medical oncologists. These neuropsychologists regularly assess glioblastoma patients before, during, and after treatment to identify and address changes in cognitive function, behavior, and mood.

"By monitoring patients over time, we can identify changes in cognitive function or behavior that may be early indicators of tumor growth. Based on those findings, physicians may consider changing therapy, monitoring the patient more closely, or offering intervention strategies and referrals for other supportive care needs," Dr. Wefel said.

According to Dr. Armstrong, experience is key in caring for this population. "One of the issues patients often say they have before they come here is that they feel very isolated. In their community, they may be seeing a doctor who has seen one other glioblastoma patient before. But here, that's all we do. Many of us see 20 or 30 patients with this disease each week," she said. "I think patients also feel comforted that there are other people here who are like them—connections are being made in their support groups or in the waiting room."

Effects of treatment

In addition to having to contend with the adverse effects of the tumor itself, glioblastoma patients receive a number of therapies that also place healthy brain tissue at risk. The standard treatment for glioblastoma patients is surgery to remove as much of the tumor as possible followed by concurrent temozolomide and radiation therapy and adjuvant temozolomide.

"These therapies are all directed at the brain, but they have very little ability to target just cancer cells. They also will affect the healthy tissue," Dr. Wefel said.

Surgery, though it has not been shown definitively to improve survival outcomes over chemoradiation with temozolomide, benefits patients by relieving the mass effect of the tumor. However, surgery often requires the transection of normal brain tissue to obtain clear surgical margins, which can result in further cognitive or neurological deficits.

Glioblastoma in Children

A rare disease in adults, glioblastoma is even rarer in children, though the disease is handled in much the same way in both populations. Pediatric glioblastoma patients receive the same treatment as adult glioblastoma patients—surgery, with complete resection if possible, followed by radiation therapy and chemotherapy—and the survival rates of the two populations are similarly poor. However, pediatric patients are much more susceptible than adult patients to the adverse cognitive effects of radiation therapy.

Although teenagers tend to tolerate radiation therapy to the brain with cognitive effects similar to those of adults, younger children suffer more cognitive loss because their brains are not fully developed.

"The younger the brain is, the more adverse effects you see from radiation," said Michael Ryttning, M.D., a professor in the Department of Pediatrics. "It used to be a hard-and-fast rule that if a child less than 3 years of age received treatment for a brain tumor, you would do anything you could not to use radiation because it would devastate the brain."

Today, however, many pediatric glioblastoma patients are referred to MD Anderson to receive proton therapy, especially when surgery and chemotherapy have not been successful.

"We've started to give younger children with glioblastomas and other aggressive brain tumors more treatment with radiation now that we can use protons," Dr. Ryttning said. "The thought is that proton therapy is more directed with less damage to surrounding tissue, so hopefully you're not affecting as much of the normal brain; but we don't yet know definitively."

Radiation-induced hormonal deficiencies are also common but treatable. For example, growth hormone therapy may be necessary to prevent significant loss of stature for patients in whom radiation has damaged the pituitary gland. Testosterone or thyroid hormone replacement therapies are often necessary for patients in whom radiation has halted the production of these hormones.

"The big issues in long-term pediatric glioblastoma survivors are hormonal deficiencies and the secondary malignancies that can happen because of radiation, including myelodysplastic syndrome and acute myeloid leukemia," Dr. Ryttning said. "These things also occur in adults, but the length of time they have for these things to develop is quite a bit shorter."

Another less devastating concern stemming from radiation therapy is hair loss. Although chemotherapy is well known to cause temporary hair loss, some patients do not realize that radiation delivered to the scalp can cause permanent hair loss.

"Even at smaller doses, patients can have very thin hair, and that can really bother them," Dr. Ryttning said. "When they get a high radiation dose focally, they get areas where the hair just doesn't grow back very well. This isn't such a big deal when you're 50, but it can be when you're 15."

FOR MORE INFORMATION
Dr. Michael Ryttning .......................................................... 713-792-4855

Radiation therapy, by far the most effective treatment against glioblastoma, can cause permanent hair loss and short-term fatigue; over time, it can increase patients' risk for secondary tumors and result in additional cognitive and neurological impairments.
Survivorship Issues in Glioblastoma Patients
[Continued from page 3]

Temozolomide, despite the survival benefit it has shown, nevertheless increases patients’ risk of infection and can cause fatigue, nausea, or vomiting. In fact, temozolomide may increase the neurotoxicity of radiation.

“We think that temozolomide may work in part by being a radiation sensitizer—making the radiation more effective—and that’s great in terms of destroying the tumor, but then you’re left with the side effects of radiation to the brain,” Dr. de Groot said.

Glioblastoma patients who receive bevacizumab for recurrent disease may experience high blood pressure, be at a higher risk for stroke, and have blood-related issues such as hemorrhaging, clotting, and wound-healing complications.

The effects of glioblastoma and its treatments can also give rise to a number of physical, functional, and social issues that affect patients’ quality of life. For example, only 20%–30% of patients return to a competitive work environment, usually with accommodations or a reduced role.

A number of intervention approaches, many in their infancy, are aimed at helping glioblastoma patients cope with the fallout of the disease and its treatments. For example, Dr. Wefel is conducting a feasibility study of a computerized neuroplasticity-based cognitive exercise program for improving patients’ cognition.

“We’re very excited about it,” Dr. Wefel said. “Traditional neuropsychological rehabilitation frequently requires daily sessions for several weeks or months—and for many of our patients, coming to MD Anderson that often just isn’t possible.”

Other interventions aim to address the roots of specific issues. Many glioblastoma patients experience seizures even after the tumor has been removed; rather than addressing the aftermath of the seizures, Dr. Armstrong and her colleagues are investigating whether prophylactic anticonvulsants can prevent or delay the occurrence of seizures.

Dr. Armstrong’s team also found that patients who received a high dose of radiation to the pineal gland had high levels

[Continued on page 8]

Prediction Tool Helps Determine Who Breast Cancer Patients Will Benefit

By Amelia Scholtz

A statistical tool is now available to predict the likely individual benefit of radiation therapy for older women who have undergone breast-conserving surgery for breast cancer.

The prediction tool is based on a nomogram that uses patient-specific factors to calculate a patient’s risk of requiring subsequent mastectomy—the most common treatment for local breast cancer recurrence—within 5 and 10 years after breast-conserving surgery alone and after breast-conserving surgery plus adjuvant radiation therapy.

“The question of when it is okay to treat older women with breast cancer using lumpectomy without radiation has been an ongoing source of controversy,” said Benjamin Smith, M.D., an assistant professor in the Department of Radiation Oncology at The University of Texas MD Anderson Cancer Center. He and colleagues from MD Anderson and the University of Chicago conducted the study that produced the nomogram. “Our concern was that the National Comprehensive Cancer Network guideline statement was not sufficiently nuanced to truly capture the breadth of types of patients for whom radiation therapy can be omitted,” Dr. Smith said.

The decision-making tool

The decision-making tool, which is available on MD Anderson’s Web site, first asks the user to designate the patient’s age and race, the tumor’s size and estrogen receptor status, and the lymph node status. The tool then provides the described patient’s risks of needing a mastectomy by 5 and 10 years after surgery with and without radiation. For example, a physician might select an age of 66–69 years, white race, tumor size of 2.0 cm or less, negative or borderline-positive estrogen receptor status, and negative nodal status that was assessed clinically but not pathologically. For a patient with those characteristics, the nomogram calculates the risks of needing mastectomy by 5 and 10 years to be 9% and 21%, respectively, if the patient does not receive radiation therapy; however, if the patient does receive radiation therapy, the risks of needing mastectomy by 5 and 10 years are 2% and 5%, respectively.

The online tool offers advantages for both clinicians and patients. “For physicians, risk prediction tools that allow you to take the experience from the literature and then apply it to your patient can really improve decision making,” Dr. Smith said. The tool also facilitates patient autonomy in decision-making by showing the likely benefit of radiation therapy in easily understood terms.

The research behind the tool

The process of creating the nomogram began with Dr. Smith and his colleagues using the Surveillance, Epidemiology, and End Results–Medicare database to identify women who were diagnosed with breast cancer at ages 66–79 years between 1992 and 2002 and who had no cancer history. Women 80 years and older were excluded because the team’s earlier research suggested that those patients were unlikely to benefit significantly from radiation therapy. Also excluded were patients diagnosed with ductal carcinoma in situ and those with missing
Whether Older fit from Radiation

Nomogram for Calculating 5- and 10-Year Mastectomy-Free Survival Probabilities for Older Patients After Breast-Conserving Surgery for Breast Cancer

1. Find the value for each factor by drawing a vertical line from that factor to the POINTS scale.

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2. Add the individual values, and draw a vertical line from the TOTAL POINTS scale to the 5- and 10-year probability lines.

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Data. The final cohort included approximately 16,000 patients, 89% of whom received radiation therapy after their initial surgery.

The next step was to identify risk factors for subsequent mastectomy. Younger age, larger tumor size, and black race were found to be independent risk factors for mastectomy in the patient cohort. The researchers also studied which patients received the greatest benefit from adjuvant radiation therapy. Estrogen receptor positivity was associated with lower tumor grade, which itself was associated with a smaller benefit from radiation. Patients who had pathologically confirmed disease in one or more lymph nodes or who had node-negative disease that had been diagnosed only clinically were the most likely to benefit from radiation therapy.

Yu Shen, Ph.D., a professor in the Department of Biostatistics, and Diane Liu, M.S., a statistical analyst in that department, used these data to generate the nomogram in consultation with physician-scientists. They then internally validated the nomogram, and after some refinement, its accuracy was similar to that of predictive tools used for other purposes in clinical practice.

The observational data used to produce the nomogram had several limitations worth noting. The cohort included relatively few black women, making it difficult for researchers to determine why black race appeared to be a risk factor for subsequent mastectomy. Additionally, the use of mastectomy as a proxy for local disease recurrence does not account for the minority of recurrences that are treated with lumpectomy. Therefore, the absolute risk of recurrence is almost certainly higher than the risk of mastectomy recorded in the study. Finally, data for additional possible risk factors such as surgical margin status and lymphovascular space invasion were not available.

Despite these limitations, the results produced by the nomogram are consistent with the findings of a 10-year, prospective, randomized trial reported by Hughes and colleagues at the annual American Society of Clinical Oncology meeting in 2010. Moreover, Dr. Smith is hopeful that his team will ultimately be able to externally validate the data on which the nomogram is based, possibly using data from other population-based tumor registries.

Physicians and patients can access the prediction tool and other clinical calculators at http://www.mdanderson.org/education-and-research/resources-for-professionals/clinical-tools-and-resources/clinical-calculators/index.html.
Sequential Multidrug Regimen May Offer an Alternative to Standard Cisplatin-Based Therapy for Urothelial Cancer

By Luanne Jorewicz

Cisplatin-based chemotherapy is the standard neoadjuvant treatment for high-risk, surgically resectable, invasive urothelial cancer. But some patients are not good candidates for this chemotherapy owing to certain disease characteristics or comorbidities.

These patients may benefit from an alternative regimen of sequential neoadjuvant chemotherapy with ifosfamide, doxorubicin, and gemcitabine (IAG) followed by gemcitabine, low-dose cisplatin, and ifosfamide (CGI), according to the results of a recent clinical trial.

Such sequential chemotherapy is not typically prescribed in the neoadjuvant setting, according to Arlene Siefker-Radtke, M.D., an associate professor in the Department of Genitourinary Medical Oncology at The University of Texas MD Anderson Cancer Center and the trial’s principal investigator. In designing the study, however, Dr. Siefker-Radtke and her colleagues hypothesized that a sequential approach that included a strong alkylating agent up front followed by a reduced cisplatin dose would minimize the toxic effects of cisplatin.

“The sequential regimen provides an alternative that may benefit some patients,” Dr. Siefker-Radtke said.

The phase II trial enrolled 65 patients who had resectable invasive urothelial cancer and had high-risk characteristics including lymphovascular invasion, hydronephrosis, micropapillary tumors, upper tract disease, or clinical T3b or T4a disease.

The patients were scheduled to receive three cycles of IAG followed by four cycles of CGI. The IAG regimen, which was composed of ifosfamide with mesna on days 1-4, doxorubicin on day 3, and gemcitabine on days 2 and 4, was given with growth factor support in an inpatient setting and repeated every 3 weeks. The CGI regimen, which was composed of gemcitabine, ifosfamide, and cisplatin with mannitol on the same day every 2 weeks, was given with growth factor support as needed in an inpatient or outpatient clinic. Patients underwent cystoscopy after 6 weeks of treatment, and IAG was continued in patients whose tumors responded to the therapy but discontinued early in patients whose tumors did not respond. Patients whose tumors had not responded were switched to six cycles of CGI.

The trial’s primary endpoint was tumor downstaging to pathologic (p) T1N0 disease or lower at the time of cystectomy; such downstaging occurred in 30 of the 60 patients who had primary bladder tumors and 3 of the 5 patients who had primary tumors of the renal pelvis. Fifty-five percent of patients who completed three cycles of IAG before receiving CGI had their disease downstaged to pT1N0 or lower. Twenty-six percent of patients who switched to CGI early because of lack of response or toxicity had their disease downstaged to pT1N0.

Only two of the patients whose disease did not respond to IAG achieved pT0 disease after CGI. Dr. Siefker-Radtke said this might indicate that the lower doses of cisplatin and ifosfamide in the CGI regimen were not sufficient to kill IAG-resistant tumor cells.

Patients who had pT1N0 disease or lower, pT2-T3aN0 disease, or pT3b disease or higher or lymph node-positive disease had 5-year overall survival rates of 87%, 67%, and 27%, respectively. Together, the patients had a 63% 5-year overall survival rate and a 68% 5-year disease-specific survival rate. These results were similar to what has been seen historically with cisplatin-based chemotherapy, suggesting that the sequential regimen may be a suitable alternative for some patients who are not able to receive full-dose cisplatin.

One patient died of pneumonia during the first cycle of IAG. Three patients experienced grade 4 toxicities; grade 3 toxicities were more common but not overwhelming. No patient developed peripheral neuropathy as a result of chemotherapy. Eleven patients required dose reductions of IAG, and 10 patients required dose reductions of CGI. The report of the study was published this February in Cancer.

Dr. Siefker-Radtke said that although the regimen is not a good fit for all patients—especially those with poor renal function—it may be an attractive alternative for patients who are not good candidates for the standard regimen, such as those who have preexisting peripheral neuropathy or hearing loss that may worsen with cisplatin treatment.

FOR MORE INFORMATION
Dr. Arlene Siefker-Radtke...... 713-792-2830
Cancer patients write blogs for many reasons—to inform, to inspire, or just to vent their emotions. The reasons for blogging and the topics vary widely, and each blogger has a unique story to tell.

**Diaries and dialogues**

One such blogger is [masked], a biologist with years of experience in cancer research. Last September, he was shocked to learn that he, too, had breast cancer. To chronicle his experience as a patient, he created an online journal:

> “I started writing a couple of weeks after my diagnosis, so it’s allowed me to keep a sort of diary and track the trajectory I’m on in my treatment,” [masked] said. “When I was younger I kept a diary, so I was aware that writing can be therapeutic.”

Some bloggers write to keep friends and family members updated about the status of their cancer treatment. It’s not unusual to see blog posts showing a patient’s lab results or treatment schedules. Services such as www.caringbridge.org and www.carepages.com allow patients to set up private blogs that can be viewed by invitation only. Patients or caregivers who lack the time or energy to contact people individually can use these blogs to stay in touch with loved ones.

Blogs can also be used to connect with cancer patients and survivors who have similar experiences. Blog Nation, a network of bloggers, has two directories of cancer blogs at www.blognation.com/directories. One of these directories is devoted to breast cancer, and the other includes blogs about other types of cancer. Another site, www.beingcancer.net, lists more than 1,500 cancer blogs. Such networks allow patients to find other patients' blogs and to communicate in the blogs' comment sections.

Many bloggers use Facebook and Twitter to find others with similar interests. “I’ve connected with other bloggers through a Twitter network called Breast Cancer Social Media, which meets online Mondays at 8 p.m. Central time,” [masked] said. The group—which includes bloggers, patient advocates, and physicians—communicates on Twitter by writing messages with the hash tag #BCSM. Recently, members of the group launched an independent Web site, www.bcscommunity.org.

**Education and advocacy**

“If you think you have a unique perspective to share, a blog is a good way to join the discussion,” [masked] said. His experience as a scientist and a patient enables him to describe cancer biology in terms that patients can relate to. For example, this spring [masked] learned that the cancer had spread to six of his lymph nodes. [masked] explained the significance of this finding in a blog post dated April 12:

> [masked] also wanted his blog to raise awareness about breast cancer in men. He said that the current lack of awareness among patients and physicians causes some men to be diagnosed at later stages, when the cancer is more difficult to treat or has spread to distant organs. To advance his goals of education and awareness, [masked] has added a video page to his blog.

**Multimedia blogs**

Video blogs are not uncommon, and most traditional blogging platforms allow bloggers to upload video clips. Some cancer patients skip writing altogether and blog on YouTube. For example, a patient named [masked] documented his acute lymphoblastic leukemia on YouTube.

Traditional written blogs or YouTube channels can be started easily at no cost. In addition to the blog network sites listed above, Google and www.wordpress.com offer tools to set up blogs for any purpose.

Regardless of their format, blogs provide an outlet for their writers. And for readers affected by cancer, patient blogs may provide valuable insight and guidance.

— B. Tutt

**FOR MORE INFORMATION**

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Survivorship Issues in Glioblastoma Patients

[Continued from page 4]

of melatonin—a hormone that helps regulate the sleep-wake cycle—during the day, resulting in fatigue. In response to these findings, the group plans to explore methods of regulating melatonin to prevent fatigue.

“We’re trying to take a step back and look at the biology underlying the fatigue,” Dr. Armstrong said. “Instead of just giving patients something to deal with the fatigue, we hope to prevent the fatigue from occurring in the first place.”

Focusing on survival

Even as the concept of glioblastoma survivorship emerges, the focus remains on extending patients’ lives by adjusting existing therapies and identifying new approaches to combat the disease. For example, radiation oncologists are developing methods to more effectively limit the amount of radiation to normal brain tissue. These methods include proton therapy, which theoretically can be more accurately delivered to the tumor and spare normal brain tissue.

Clinical trials in glioblastoma are investigating the use of agents that have shown promise against other cancers or other diseases. For example, the addition of vorinostat (used to treat cutaneous T-cell lymphoma) to bevacizumab is being tested in patients with glioblastoma, as is the addition of memantine, melphalan, and metformin (used to treat Alzheimer disease, malaria, and type 2 diabetes, respectively) to adjuvant temozolomide. Other glioblastoma trials are investigating the potential of novel agents and nontraditional therapies such as replication-competent adenovirus (Delta-24-RGD).

Data from projects such as The Cancer Genome Atlas are driving additional avenues of glioblastoma research. With these data, researchers hope to identify biomarkers that can be used to determine which patients will benefit from specific treatments.

“I think that people who have been treating this disease for 30 years definitely see this time as the initial stage of a new era,” Dr. de Groot said. “A lot of people are thinking that we’re on the verge of a breakthrough that sets us in motion to really improve the survival of patients with glioblastoma.”

“Ten years ago, people were not talking about brain tumor survivorship issues. But this new standard of care seems to have shifted the bar.”

— Dr. John de Groot

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