

The Impact of Gliomas on Cognition and Capacity

Jason Lee, MD, and Ryan Chaloner Winton Hall, MD

Brain tumors, particularly gliomas, can have profound effects on cognitive functioning. The cognitive effects that can occur due to a glioma are not just due to the tumor itself, but also from the treatment modalities used. In-depth neuropsychiatric testing or screening is typically necessary to determine the extent of cognitive impairments and the rate of progression, especially given that physical functioning may be better than cognitive functioning. Given the high mortality rate and fast-growing nature of gliomas, patients often have to make significant and consequential decisions in relatively short periods of time, such as consent for treatments and personal planning (e.g., preparing a will, assigning power of attorney). In a postmortem context, forensic psychiatrists may have to make determinations regarding whether a person had capacity at the time many of these decisions were made. This article discusses some of the unique cognitive concerns that arise from gliomas and their impact on patient care and personal decision-making, both contemporaneously and in a postmortem context.

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Within the past 15 years, two United States senators, Ted Kennedy and John McCain, have been diagnosed with glioblastoma multiforme (GBM) brain tumors.¹ In both cases, the senators continued with their work for a period of time after diagnosis and cast significant votes on health care legislation, which affected millions of Americans' lives. Although there was no official inquiry regarding their capacity to continue to serve as United States senators, the topic was raised speculatively on television shows and in newspaper editorials as a hypothetical exercise.

On a more practical level, the concern for capacity to consent to treatment or to engage in financial decision-making arises for the roughly 15,000 newly diagnosed cases of GBM each year in the United States.² A somewhat unique aspect of capacity consideration with GBM is the question of whether there are more likely to be windows of capacity, especially after treatment interventions. Unlike other forms of illness that affect brain tissue, such as one-time events (e.g., traumatic brain injury, stroke) or

slowly to moderately progressive diseases (e.g., Alzheimer's dementia, Creutzfeldt–Jakob disease), GBM deficits may ameliorate with treatment intervention (e.g., debulking surgery) only to potentially have the tumor and deficits return within a relatively short period of time (e.g., three months to a year). In addition, gliomas are rarely detected by routine preventive screening and do not have classic phenotype at-risk populations like other conditions affecting the brain (e.g., hypertension with stroke, family history and age with types of dementia). An individual usually presents when the tumor has reached a point where there are noticeable symptoms (e.g., seizures, headaches, vision changes, coordination deficits, personality changes), many of which can impair cognition and capacity.^{2–5}

In addition, GBM is often treated with multiple modalities that can have varying effects on cognition, which may make it difficult to cite literature to support when windows of capacity may exist or how long they may last. For example, even though there is some literature examining cognitive function after a single surgical intervention to treat GBM, studies do not appear to consider multiple surgical interventions. By common sense and abstraction from other conditions, such as repetitive strokes, multiple sclerosis flares, or other types of brain tumors, it would seem that the more surgeries or treatments performed, as well as the more recurrences experienced,

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Dr. Lee is a Psychiatry Resident, Cleveland Clinic Foundation, Cleveland, Ohio. Dr. Hall is Assistant Professor, University of Central Florida College of Medicine, Orlando, Florida, and Affiliate Assistant Professor, University of South Florida, Tampa, Florida. Address correspondence to Ryan Chaloner Winton Hall, MD, 2500 West Lake Mary Blvd Suite 219 Lake Mary, FL 32746. E-mail: dr.rcwhall@live.com.

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the poorer the cognitive functioning would be. Although this idea seems logical, are these conditions reasonable proxies from which to interpret neurocognitive functioning (NCF)? Could a forensic expert's opinions, especially one extrapolated from other brain conditions, survive a *Daubert* challenge?

The personal and emotional responses that an individual and the family have to the condition may also make it difficult to opine on windows of capacity, especially in a postmortem situation. Are assessments of functioning, by lay people or even by doctors, potentially biased because they need to justify decisions made (e.g., being aggressive with temporarily prolonging palliative treatment versus deciding not to continue to pursue additional intervention)? Will individuals who think that palliative treatments may lead to the individual surviving cancer only focus on the positive aspects of an individual's functioning (e.g., moving better) and therefore not truly appreciate the strengths, weaknesses, or lack of change a patient may have in other domains (e.g., cognition)? If potential over- or underestimation of an individual's functioning with GBM is occurring, is this bias caused by emotional factors, such as not being able to admit someone is dying, or by self-interest?

Although aspects of all of these questions can be seen when assessing capacity in any medical condition, as this article will discuss, GBM does present some unique challenges due to the nature of treatments, the areas of the brain affected, the aggressive nature of such tumors, the speed of symptom progression, and limitations of the medical literature.

Impact on Neurocognitive Functioning

GBM is a fast-growing tumor with undifferentiated cell morphology and microscopic finger-like projections that invade surrounding areas of the brain. Healthy parenchymal tissue surrounding a GBM is often rapidly compromised, resulting in relatively swift symptom progression and cognitive decline greater than what would be expected from neuroimaging results alone. The growth rate of GBM is exceptionally quick, with the size of the tumor doubling in a median of seven weeks' time if untreated or unresponsive to treatment.⁶ GBM is particularly challenging to treat due to intratumor heterogeneity, whereby different regions within a single tumor are composed of different subgroups of tumor cells with different molecular characteristics, hence the subname "multiforme."^{7,8} This complexity often results

Table 1 Pooled Median Survival in Months for Common Brain Tumors

Grade	Prognosis, months
Astrocytoma	
Grade I (pilocytic astrocytoma)	Often cured with surgery
Grade II (astrocytoma)	48–180
Grade III (anaplastic astrocytoma)	18–36
Grade IV (glioblastoma multiforme)	4.25–12
Oligodendroglioma	
Grade II (oligodendrogliomas)	55.2–204
Grade III (anaplastic oligoastrocytoma)	42–120
Primary CNS lymphoma	17–84

Prognosis data are from References 12-19. CNS, central nervous system.

in the need for varying therapeutic strategies that can result in different or compounding side-effect profiles, especially on cognition. Even after surgical resection and adjunct treatment with radiation or chemotherapeutic treatments, GBM typically recurs within an average of 6.9 months.⁹ In part, this resistance to standard treatment is why the five-year survival rate of GBM is less than 5 percent (Table 1).^{10,11} Depending on multiple factors, such as the type or grade of the tumor, the brain areas affected, the length of time with the disease, and confounding variables (e.g., depression, sleep disruptions), many individuals with gliomas will have their cognitive functioning affected.^{19–22}

Research studies have reported that brain tumors, either primary or metastatic, commonly affect NCF, with as many as 75 to 80 percent of adults who undergo in-depth neurocognitive assessment at the time of treatment presentation showing some degree of cognitive impairment.^{23–27} For example, Dwan and colleagues²⁵ studied 44 subjects with benign-to-low-grade (stage I–II) and malignant (stage III–IV) primary brain tumors and reported that 86 to 89 percent of subjects were classified as impaired at a test-specific level, 61 to 73 percent were classified as impaired at a domain-specific level, and 32 to 50 percent were classified as impaired at a global level. In the study, participants with brain tumors performed significantly below matched controls on tests of neuropsychological functioning, including executive function ($p = .001$) and memory ($p < .001$), but not for attention and processing speed ($p > .05$). This led to a recommendation that performance be measured using a multifaceted neuropsychological approach, otherwise specific deficits would not be appreciated.²⁵ Similar results have also been reported after surgical intervention, where there may be an improvement in one cognitive domain but a

worsening in another, which means multiple domains must be tested to appreciate overall functioning.²⁸

The location of a tumor can also have a profound impact on deficits observed (e.g., damage in Broca's area results in an expressive aphasia), which often have ramifications for NCF and capacity. Patients with frontal lobe tumors not only show decreased inhibitory control, but also poorer executive functioning than those with non-frontal lobe tumors.²⁹ Noll and colleagues recently reported that patients with left temporal lobe gliomas of varying grades had frequent impairments in verbal learning and memory, executive functioning, language, and attention.²⁸ Other researchers have also found similar results when comparing right versus left temporal lobe location of primary tumors, in that left-sided tumors resulted in greater deficits in general.^{26,30} Few of these studies tried to differentiate whether the effects corresponded with premorbid temporal dominance, however, which may have influenced outcomes.

Noll and colleagues also reported that, as grading worsened, the effects of impairment significantly increased independent of lesion size, seizure status, and medication treatment (e.g., antiepileptics, steroids), a finding that supports the concept of lesion momentum.²⁸ Unfortunately, there are a limited number of studies comparing the impact of low-grade gliomas to high-grade gliomas.^{31,32} An additional concern for much of the literature on gliomas is that the studies' population sizes are often small and are usually limited to a single inpatient treatment location, which may increase the risk of sampling bias or procedural bias in the studies.

Although gliomas and other tumors may primarily present in a specific region of the brain, the overall impact on functioning may be difficult to predict due to the global effects. For example, a brain tumor may result in displacement of adjacent brain tissue, which can impede blood flow or cause increased intracranial pressure, endocrine disruptions, swelling, or edema.^{25,33} These more chronic, diffuse effects of brain tumors are, in part, the reason that brain tumor lesions have been shown to impair cognition more significantly than other forms of brain damage, such as stroke or mechanical trauma, where effects from edema tend to be more temporary.^{26,34}

Cognitive Functioning Post-Treatment

Neurosurgical treatment is a common, if not primary, treatment method for many solid brain tu-

mors.^{2,35} The effects of surgery are difficult to predict, however, given the individual characteristics of each case, such as the varying areas of the brain that may be affected, the size or grading of the tumor, the surgical approach required, the degree of margin resection, and the historical lack of sufficient pre- and postoperative assessment studies.³⁵⁻³⁷ While resection of a glioma is an inherently risky surgical procedure, most studies suggest that their removal (with or without clean margins) is possible without major long-term impairment of cognitive functioning due specifically to the surgery.^{23,38} The effect size and duration of improvement varies from case to case and often depends on how well the glioma responds to adjunct treatment and how rapidly the glioma returns.²³

A recent Austrian study, for example, reported that, while the majority of 196 subjects with malignant gliomas, brain metastases, and meningiomas showed significant deficits in various neurocognitive domains presurgery, most either improved or did not decline further in terms of NCF in the short term after resection (i.e., 3 to 4 months).²⁴ This finding may be of particular importance to forensic examiners trying to determine, in a postmortem review, when an individual may have had the best cognitive functioning, or to advise when cognitive functioning may be at its best when it comes to creating or modifying legal documents.

The results of the Austrian study are similar to results found in a study by Habets and colleagues, which analyzed high-grade gliomas specifically.³⁹ They reported that 79 percent of the 62 subjects demonstrated cognitive impairment in at least one cognitive domain (e.g., verbal and working memory, attention, executive functioning, psychomotor function, information processing speed, or visual-spatial abilities) prior to surgery. At an average of five weeks after surgery, 39 subjects (63% of the original participants) were again tested, and 59 percent of that subgroup still showed deficits in at least one cognitive domain. Almost half (49%) of the surgically treated population showed improvement in cognitive function from presurgical baselines, whereas 23 percent showed further decline from presurgical baselines.³⁹ Another study of 29 subjects with gliomas reported that 55 percent of patients were unchanged after surgery, 21 percent improved, and 24 percent worsened in functioning in cognitive domains such as intelligence, executive functions, memory, and language.³⁷

The degree of worsening is similar for the two studies, but the degree of improvement was much larger for the first study. It should be noted, however, that many participants in the first study (37%) refused or were unable to repeat the testing postsurgery for various reasons (e.g., the testing was seen as too bothersome, or the subjects elected to not pursue additional treatment). Therefore, a potential limitation of several of the treatment studies is that they may reflect an optimistic or best-case scenario because the sickest patients or ones with limited responses may have dropped out.^{37,39}

The timing of a cognitive assessment can also affect the perceived benefit of the intervention because some negative impacts from surgery may resolve with time, such as edema. As an example, Wolf and colleagues noted worsening in cognitive functioning of surgical patients at the time of discharge from the hospital, with degrees of improvement occurring by the three-month mark.⁴⁰

In contrast to tumor resection, radiation therapy, a second modality for treating brain cancer, has been reported to more frequently and markedly impair NCF, depending on the delivery method (e.g., beam radiation versus whole brain), dose, and duration of treatment.^{34,36,41–44} In addition to general neurophysiological problems, patients who undergo radiotherapy also commonly exhibit cognitive or functional decline related to secondary factors, such as anxiety, depression, fatigue, and sleep disturbances.²³ Research on subjects who received radiation therapy for brain tumors showed increased topological modularity (i.e., less communication across cortical subnetworks), a finding that is associated with working memory deficits.^{42,45} The effects of radiation therapy and the time for these effects to become evident may also depend on the dose (e.g., less than 2 Gy for low-grade gliomas has fewer effects and these effects take longer to manifest themselves than effects seen in patients receiving 60 Gy for high-grade gliomas).³⁶

Glioma patients typically are prescribed various pharmacological treatments, often including multiple classes of medications such as cortical steroids, anti-seizure medications, chemotherapy, and palliative medications (e.g., antiemetics), any of which can also affect NCF.^{20,36} For example, topiramate has been shown, both in healthy patients and in patients with other central nervous system disorders such as epilepsy, to have effects on NCF, with impaired do-

main including visual-spatial memory, concentration, word fluency, verbal learning, and executive functioning.^{46–49} Although the impact of topiramate alone may not be enough to cause one to lose capacity, it may have a more significant impact for an individual already dealing with cognitive deficits caused by other factors. A study looking at capacity to provide consent for research in patients with malignant gliomas noted that subjects on cortical steroid treatments and anticonvulsants were found to have poorer performance on the Capacity to Consent to Research Instrument⁵⁰ than those not prescribed the medications. Given that this study found that “phonemic and semantic word fluency predicted performance on the consent standards” (Ref. 50, p 3884), it is not surprising that anticonvulsants, some of which can affect word fluency, were associated with decreased capacity. It should also be noted that the studies reporting deficits with certain pharmacological treatments may serve more as a marker for the severity of the disease state or of a particular subtype of patient who is more willing to pursue aggressive treatment than the direct effects of the medication.

Traditional chemotherapeutic agents may also affect cognition in multiple ways, including neurotoxic effects (e.g., affects healthy progenitor cells as well as cancer cells) and side effects such as fatigue, which may further affect domains such as attention and concentration.²¹

The research literature does not specifically address how potential treatment combinations may interact or affect cognition. This may present a challenge for the forensic examiner, especially if there is a *Daubert* challenge, who must seek peer-reviewed literature supporting the confounding effects of treatment. In a peer-reviewed study that addresses this concern, Nolen and colleagues investigated hippocampal volumes in 13 subjects with high-grade gliomas.⁵¹ The subjects received surgical, radiation, and chemotherapy treatment (the primary agent was temozolomide, often followed with a course of bevacizumab). Subjects were all affected by hippocampus loss as well as learning and memory deficits, but those who were exposed to more treatment modalities (e.g., radiation and both chemotherapy drugs) for longer periods of time had greater deterioration of hippocampal volume and more deficits on tasks associated with hippocampal functioning. The authors focused on the hippocampus because that is an area

of the brain also affected and studied in Alzheimer's dementia. They noted that once hippocampal change began, the loss of volume ensued at a rate faster than that typically seen with Alzheimer's dementia. A significant decrease in hippocampal volume was usually evident on magnetic resonance imaging after six months of treatment with bevacizumab, with continued change noted for up to a three-year time period. Although this study had a limited sample size, it does provide a good model to show the complex nature and interactions of varying treatment modalities and how there may be similarities as well as differences in the pathophysiology and progression of other disease states.

Capacity

Although cognitive functioning and capacity are not necessarily synonymous, a person's ability to consent to medical treatment or make important end-of-life decisions does require adequate NCF in domains such as memory, executive functioning, and language. Previous studies analyzing decision-making capacity in patients diagnosed with high-grade gliomas reported that nearly 90 percent of these patients lacked decision-making capacity in their final days before death, and some lacked decision-making capacity soon after being diagnosed.^{33,52}

Grisso and Applebaum originally proposed four criteria for decision-making capacity, which include the ability to communicate a choice, understand the relevant information, appreciate the situation and its consequences, and reason about treatment options.⁵³⁻⁵⁵ The concepts are assessed in The MacArthur Competence Assessment Tool for Clinical Research, which was designed to offer a structured method for rating a person's abilities relevant to consenting to treatment.^{55,56} In addition, there are other assessment tools available for capacity, such as the Capacity to Consent to Treatment Instrument (CCTI), which uses hypothetical clinical vignettes in a structured interview to assess capacity.⁵⁰

In a study using the CCTI in individuals with newly diagnosed brain metastases, it was reported that simple attention, verbal fluency, verbal memory, processing speed, and executive functioning were all associated with understanding.²⁷ Verbal memory (e.g., episodic memory) and phonemic fluency were found to be the two best cognitive domains in which to assess initial deficits if an individual lacked capacity for medical decision-making at the time of diag-

Table 2 Testamentary Capacity Factors

Understands what a will is
Knows one's assets
Knows one's natural heirs
Decisions on how assets are distributed are not influenced by delusional beliefs
Person is not a victim of undue influence

Source: Reference 57.

nosis.²⁷ When comparing the 41 subjects to healthy controls, it was found that 60 percent of the subjects with cancer demonstrated impaired capacity to consent (defined as 1.5 SD below the control group on capacity measures), with limitations being present shortly after diagnosis.²⁷ In a study of 26 subjects with malignant gliomas, capacity for medical decision-making was again assessed with the CCTI, with specific domain breakdowns being reported.³³ More than 50 percent of those with malignant gliomas demonstrated capacity compromise (i.e., a combination of marginally capable and incapable outcomes) in understanding, 35 percent in reasoning, and 23 percent in appreciation.³³

Although assessment tools can be helpful, especially in a research setting, they often are not utilized in clinical treatment settings.⁵⁷⁻⁵⁹ In addition, assessments for capacity for treatment may not be helpful for all determinations that need to be made.⁶⁰ For example, some capacity situations, such as testamentary capacity (described in Table 2), are not necessarily included on standard screens of capacity to consent for treatment.⁶¹ In addition, other formal mental health screenings, such as delirium screenings, or clinical observations that an individual is "lucid" or "oriented times three," may not necessarily provide useful information regarding a patient's general higher-level thought process, comprehension, or delusional state.⁶² This general concept was highlighted in the testamentary capacity case of *Miami Rescue Mission v. Roberts* (2006), where the Appellate Court ruled:

We also find that the trial court correctly interpreted the legal effect of the evidence presented to it. Appellant cites to evidence in the record that Mrs. Manucy was found to be alert by the nurses treating her throughout her hospitalization. Dr. Ubeda, however, testified that he disagreed with the nurses' classification, and Dr. Currier explained that certain forms of delirium are often mistaken as cooperativeness in a patient. Further, a nurse's observation that a patient is alert does not equate to a legal finding that the patient possesses testamentary capacity . . . We find that the trial court correctly determined that Mrs. Manucy was suffering from an insane delusion regarding Roberts and

Table 3 Karnofsky Performance Scale^{65, 66}

100: Normal; no complaints; no evidence of disease
90: Able to carry on normal activity; minor signs or symptoms of disease
80: Normal activity with effort; some signs or symptoms of disease
70: Cares for self; unable to carry on normal activity or to do active work
60: Requires occasional assistance, but is able to care for most of their personal needs
50: Requires considerable assistance and frequent medical care
40: Disabled; requires special care and assistance
30: Severely disabled; hospital admission is indicated although death not imminent
20: Very sick; hospital admission necessary; active supportive treatment necessary
10: Moribund; fatal processes progressing rapidly
0: Dead

that she executed her 2005 will based on this delusion [Ref. 63, p 276].

With this being said, screens for general cognitive ability can be used to help a clinician determine capacity in conjunction with other information, assess the need for more formalized inquiry, or document degree of change over time.

It is often easier to objectively document or find documentation of neuromuscular changes or declines related to tumors (e.g., changes in gait, changes in handwriting) than cognitive changes in patient records. But motor strip damage or preserved motor functioning may not directly correlate with executive functioning or general cognitive abilities.^{28,34,64} For example, a study of caregivers of patients with brain tumors noted that impairments of memory, reasoning, problem-solving, and judgment were the most frequently cited problems, with concerns regarding balance, walking, and speaking being less frequently identified.³⁴ Another example is a study of a mixed group of subjects with either malignant glioma or metastasis, which reported that medical decision-making capacity and cognitive functioning were correlated with scores from the Karnofsky Performance Status Scale (KPS),^{65, 66} although the KPS scores did not necessarily predict capacity.⁶⁷ The KPS (Table 3) is a frequently used scale in oncology that rates patients on the basis of their degree of functional impairment, such as the ability to work or to care for oneself, analogous to a Global Assessment of Functioning score in psychiatry. The KPS score tends to be heavily influenced more by physical functioning (e.g., ability to ambulate) than by upper-level cognitive abilities.³⁴ Hence, 46 percent of participants

with a KPS score of 90–100 achieved capable classifications across all CCTI standards (of note, every subject that was rated at 100 passed), while only 23 percent of participants with KPS ratings of 70–80 and 0 percent of participants with KPS ratings of 50–60 were able to achieve the same benchmarks.⁶⁷ This concept is important for forensic examiners to understand because it is much more likely for KPS scores to be seen in oncologist charts than traditional cognitive screens or testing. There is also the potential for this scale to be used in a court situation to imply that a relatively high KPS (e.g., 70–80, cares for self) equates to capacity or stable intellectual functioning over time, but this is not necessarily the case.

Treating physicians often tend to overestimate the degree of functioning a patient has, or the amount of improvement that a treatment intervention will provide. For example, one research study of 299 subjects who underwent intracranial tumor resection reported that the surgeon overestimated the functional level 62 percent of the time at 30 days postsurgery, a tendency which “may have implications for clinical decision-making and for the accuracy of patient information” [Ref. 68, p 1173]. The possibility that treaters overestimate the degree of improvement may be important for forensic evaluators to consider when conducting postmortem forensic reviews.^{20,54,69} It may help explain why family members, and even treatment providers, may subjectively believe the patient is doing better and has more capacity than is accurate, especially when the totality of the medical records are not supportive (e.g., records from treaters who did not perform the surgery).

Discussion

Capacity in patients with GBM may best be interpreted as a moving target that needs to be constantly reassessed because patients may lose and regain capacity throughout the course of treatment. From the literature reviewed and due to the fast-growing nature of GBM, it appears that the best window for improved cognitive function is the two- to four-month period after surgery. This assertion assumes that the tumor and the patient are responding well to the adjunct treatments, and that there is no rapid regrowth of the tumor during this period. The best general markers of capacity appear to be general executive functioning and verbal skills.

Cecil discussed three concerns being raised by judges interpreting *Daubert*.⁷⁰ The first concern is that the studies cited were not applicable to the question at hand (e.g., methodology of the study or reasoning for how applied). The second concern is that the expert was demonstrating *ipse dixit* in their opinion, as noted from the *General Electric Co. v Joiner* excerpt:

But conclusions and methodology are not entirely distinct from one another. Trained experts commonly extrapolate from existing data. But nothing in either *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert. A court may conclude that there is simply too great an analytical gap between the data and the opinion proffered [Ref. 71, p 146].

The third concern was that the expert's perception may have been outwardly biased or the expert's analysis may lack objectivity.⁷⁰ The first and the second rationales are potential hazards for GBM cases because, as noted above, the scientific literature may not fully apply to the situation and GBM are aggressive tumors that are difficult to treat. In addition, relying too much on anecdotal or extrapolated evidence, which sometimes may be the best evidence available, can lead to the perception of being *ipse dixit*.

When applying the literature in a *Daubert* challenge, it is important to admit limitations (e.g., no perfect study exists because there are case-by-case variations), to highlight the case's similarities to what is available, and, if using surrogate conditions, to clearly communicate the underlying universal principle that connects the conditions (e.g., lost gray matter is lost gray matter, whether it is due to a stroke or a GBM). It may be helpful to acknowledge that the GBM literature provides a general framework that may be somewhat optimistic (e.g., people lived long enough to participate, were willing to continue in studies, and were able to consent to participate initially). The same should be stated for attempts to extrapolate function from other conditions that negatively impact the brain because GBM effects tend to lead to a more rapid decline in functioning than many other conditions (e.g., hippocampal changes with Alzheimer's disease).

In addition, when extrapolating from other conditions, the expert should note what information is available as it relates to GBM and why other conditions may have more robust data which is still applicable (e.g., a condition with a higher incidence or

prevalence rate, more opportunity for diverse research in varying community settings rather than at regional tertiary treatment centers, or studies with larger populations). There may also be times when, to maintain credibility and clear reasoning, it is important to highlight how conditions with symptoms that appear to be similar do not fully apply. For example, although both epilepsy and GBM can present with seizures, the effects of GBM are generally greater due to the finger-like projections in other areas of the brain, edema, and generally more significant gray matter damage. It is also important to make sure information is clearly communicated to the retaining attorney before the *Daubert* hearing because the attorney's comfort and understanding of the expert's opinion makes communication with the judge easier (e.g., in prehearing motions, direct or cross-examination, and side bar discussions).

A review of contemporaneous medical records will be helpful, but this can also be frustrating for the forensic examiner due to the potential lack of objective data related to cognitive function and capacity in general. As is often the case with treatment capacity, as long as the individual went along with doctors' recommendations and the majority of the family's wishes, it may be that no one will have officially assessed capacity.⁶⁰⁻⁶² It is most often the case in standard clinical settings that no formal neuropsychiatric testing is done, and there may be little to no sequential cognitive screening to assess if there was general decline or improvement with time.^{23,24}

All too often, the objective data in the clinical oncology records address only general orientation (e.g., awake and alert) or physical functioning (e.g., ability to rise from a chair, presence or lack of tremor, ability to walk unassisted). As reviewed above, orientation in and of itself does not denote capacity, and physical function has a degree of correlation but is not definitive. For these reasons, forensic examiners should pay close attention to rehabilitation reports, especially occupational and speech pathology. These are often areas where some sort of objective measure of abilities can be found (e.g., word fluency, executive functioning as related to fall risk or ability to be unsupervised). At some level, the lack of frequent cognitive screening in the oncology records may be understandable because treating doctors may not want to burden the patient, may feel that the time with the patient and family could be better spent addressing other areas of the condition or treatment,

Table 4 Proposed Signs for Family Overreporting of Functioning in GBM (When Consistently Present)

1. Frequent justification of improvement on minor physical findings that appears to be overemphasized or does not match other treatment reports
2. Pervasive and overemphasized belief that person is special (e.g., a fighter), especially after significant documented decline
3. Overreliance on spiritual beliefs for a cure, not just comfort for circumstances
4. Unwavering focused on anecdotal reports of a cure and how the patient is similar to those reports
5. Lack of acknowledgement of the meaning of words such as “palliative” (e.g., doctor’s recommendation was potentially curative not just palliative)
6. Lack of rational explanation for not applying similar past life experience to current situation (e.g., uncle’s death from brain tumor does not apply)
7. Repetitive overreliance on credentials of treating doctors (e.g., stating, “We got the best physicians, therefore he will get better [or was functioning better].”)
8. Perceived extreme and consistent minimization of deficits, even after education to the contrary (e.g., stating, “He was always bad with names” in a person with aphasia)

or may believe that they are able to make important determinations based on their global interactions and skills as a physician.

As noted in the literature discussed above, physicians can sometimes be overly optimistic when trying to assess or predict how a patient is doing or will do after an intervention. This sentiment may especially occur if the doctor is going to be the one performing or recommending the intervention. This sometimes calls into question how much weight a treating doctor’s opinion should have regarding cognitive function, especially without objective measures (e.g., the doctor may focus on improvement in one area and not notice or report decline in another). Forensic evaluators can try to assess and minimize this potential bias by reviewing the chart in totality, comparing reported functioning by doctors of different specialties or between inpatient treating doctors who engaged in more aggressive interventions and outpatient doctors who followed up in close proximity.

Optimism, especially unbridled and unfounded, does not occur only with physicians treating GBM, but it can also be seen in family members. Review of records and potential depositions may help the evaluator determine if the patient and family had a realistic expectation of the patient’s situation. In situations where a realistic expectation did not exist, there can be bias in the medical records, such as reports of better function than was actually occurring. Whether

the patient or family had realistic expectations can be difficult to determine, especially because many physicians have differing approaches on how to deliver news regarding terminal conditions (i.e., some are gentler and foster some degree of hope, while others can be blunt). Certain patterns nevertheless may be seen in families or individuals who are prone to overestimating functioning (Table 4). It is important to remember that a family’s belief that an individual was doing better than evidence in an objective review might suggest can be due to multiple factors beyond simple self-interest (e.g., guilt, grief, denial, or needing to justify worldview, especially if relying on religious justification).

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