

# Brain Tumors and Metastases



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## KEYWORDS

- Cancer rehabilitation • Brain tumor • Brain metastasis

## KEY POINTS

- Brain tumors carry a high likelihood of near-term and long-term functional sequelae.
- Although primary brain malignancy comprises just 1.4% of all cancers, the incidence of brain tumor is really higher, considering that metastatic brain tumor is estimated as being at least 10 times more common than primary brain malignancy. Benign brain tumor, with incidence more than double that of malignant primary brain tumor, is also a significant group.
- Primary brain tumors occur along the full age spectrum. In fact, primary brain malignancy is the most common solid tumor in children, and data from that group inform our knowledge of long-term outcomes.
- Brain tumors encompass an extremely wide prognostic spectrum, ranging from benign brain lesions with minimal effect on life expectancy to conditions such as metastatic brain lesions and glioblastoma, which carry unfavorable prognoses.
- Many factors, such as tumor location, oncologic characteristics, and treatment effects, influence outcomes. Radiation therapy in particular has been associated with adverse long-term effects, including late (delayed onset) effects. Corticosteroid myopathy can also be a significant morbidity.

## INTRODUCTION

Although malignant primary brain tumor (PBT), estimated at 24,790<sup>1</sup> new cases in the United States in 2016, comprises just 1.4% of all cancers, brain tumor is actually far more common when one considers benign brain tumor, with estimated incidence of more than double that, at 52,880 cases,<sup>1</sup> and metastatic brain tumor, which is yet more common. Estimated prevalence rate of individuals living with history of PBT is nearly 700,000.<sup>1,2</sup> Systematic statistical surveillance is lacking for incidence of brain metastasis, has been estimated at between 200,000 and 300,000 people per year,<sup>2</sup> or at least 10 times more common than primary brain malignancy, with more than

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half of patients with metastatic disease presenting with multiple tumors, most commonly in the cerebrum.<sup>3</sup> Brain is the most common site for central nervous system (CNS) malignancy; cranial nerves, spinal cord, and cauda equina account for a collective 10% of tumors, and pituitary and pineal tumors account for 16%.<sup>4</sup>

PBT is seen over the entire age spectrum. Although most common in adults, with median age of 59 at diagnosis,<sup>2</sup> malignant brain tumor is the most common solid tumor of childhood (more than 4600 cases estimated in 2016),<sup>2</sup> and thus, has high representation in pediatric oncology. Seven percent of all primary CNS tumors occur in children ages 0 to 19, and another nearly 9% in young adults ages 20 to 34.<sup>4</sup> Brain metastasis is uncommon in children.<sup>3</sup>

Types of tumor vary over the age spectrum, with pilocytic astrocytomas and embryonal tumors (especially medulloblastoma) most common in childhood, pituitary tumors in late adolescence and young adulthood (ages 15–34), and meningiomas and glioblastomas through the remainder of adulthood.<sup>4</sup>

Prognostically, for malignant PBT, survival varies greatly, especially by type of tumor, including in some cases by their molecular markers, and also by age, with older age being less favorable. Primary malignant brain tumor of childhood averages 74% 5-year survival, but through the full age spectrum averages just 34%, and greater than age 75 averages only 6.1%.<sup>1</sup> Of note, malignant PBT outnumbers benign PBT in childhood (3.3:1.9, per 100,000, ages 0–19), whereas benign PBT is more common than malignant PBT in adults (17.9:8.9 per 100,000).<sup>4</sup> Five-year survival for benign brain tumor is 92%.<sup>1</sup>

Brain tumors have long been recognized as producing a high rate of disabling effects, with recognition that the creation of a “culture of hope”<sup>5</sup> is an important part of management. Rehabilitation needs have historically been described in upwards of 80% of individuals with CNS malignancy,<sup>6</sup> with multiple impairments often present.<sup>7</sup> Long-term effects on employment and general health have consistently been described.<sup>8,9</sup> Rehabilitation emphasizes individualized interdisciplinary care to address the functional impact of tumor and/or treatment-related impairments. Although the rehabilitation therapy itself is similar in approach to other neurologic disorders such as stroke or traumatic brain injury, the underlying context of the oncology-related factors must be incorporated into the clinician’s perspective, so that best care and guidance can be provided. Rates of receiving rehabilitation have not been systematically studied but are generally considered to be low.<sup>10,11</sup>

This review follows the general outline of providing (1) a brief summary of relevant background information about brain tumors, (2) evidence for rehabilitation’s significant role in the supportive care of patients with brain tumor, and related management considerations, and (3) an outline of survivorship issues. These categories should be viewed as having indistinct boundaries and rather serve as a general conceptual framework to approach patient care needs over the continuum of care.

### **Primary Treatment**

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Tumor types including incidence data, standard treatments, and prognostic information are summarized in **Table 1**. MRI with and without contrast is the diagnostic modality of choice for brain tumor.<sup>12</sup>

### **Surgery**

Surgical resection is a mainstay for management of most PBT, and when feasible, for metastatic brain tumors, and has been associated with better outcomes and quality of life.<sup>13</sup> Guiding principles include maximal tumor removal when appropriate,

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