

## Metastatic Brain Tumors

### Overview

This fact sheet provides a brief overview of brain metastases. Please see **Brain Tumors: An Introduction** for more information.

### What is a brain metastasis?

Metastatic brain tumors begin as cancer in another part of the body and spread to the brain through the blood stream. There can be one tumor (metastasis) or multiple tumors (metastases *is plural*). The most common cancers that spread to the brain are lung (50%), breast (15-20%), skin melanoma (10%), kidney and colon (5%). A metastatic brain tumor may also be referred to as a "secondary" tumor. When a skin cancer metastasizes to the brain, this "brain tumor" is actually a mass of skin cancer cells (Fig. 1).

Some brain metastases appear years after the primary cancer. Others metastasize so quickly that they are discovered before the primary cancer. If the primary cancer cannot be found, it is called an "unknown" primary. A diagnostic work-up with imaging scans may be done to look for the primary cancer site. Treatment options vary depending on the location and number of brain lesions along with the location and severity of the primary cancer.

### What are the symptoms?

Symptoms of a metastasis are related to the location of the brain in which they occur and may include headaches, physical numbness or weakness, disorientation, imbalance, and seizures. Cognitive problems may include short-term memory difficulty, problems talking (aphasia), or personality and behavior changes. A metastatic brain tumor is usually found when a cancer patient begins having neurologic symptoms and a brain scan is ordered.

### Who is affected?

Metastatic (secondary) brain tumors are five times more common than primary brain tumors. About 10% to 30% of people with cancer develop a brain metastasis. There has been an increase in metastatic lesions as people are surviving cancers for longer periods of time.

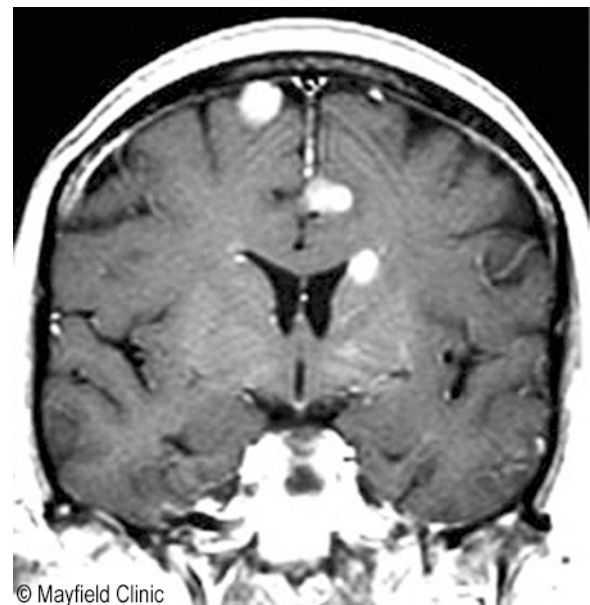
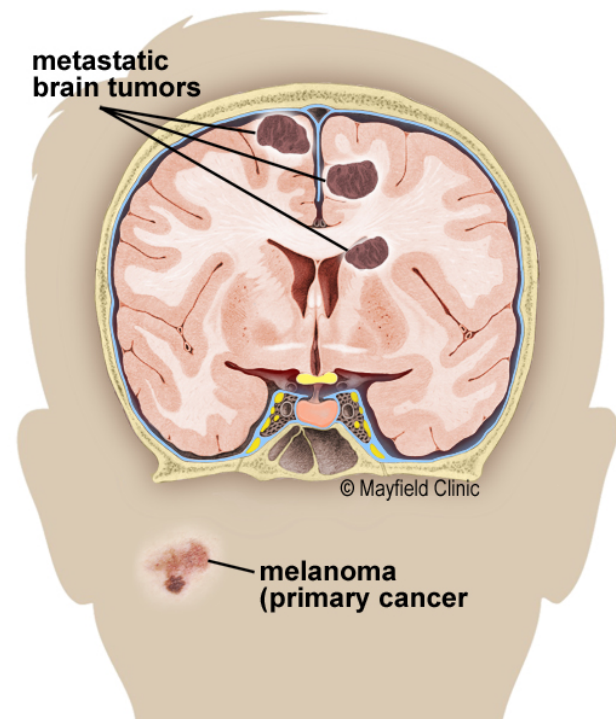


Figure 1. Illustration (top) and MRI (bottom) of multiple metastatic brain tumors that have spread from the melanoma skin cancer on the face.

## How is a diagnosis made?

An MRI scan of the brain is the diagnostic tool of choice. An MRI showing multiple lesions is very suggestive of metastatic tumors. A diagnostic work-up may be performed to look for the primary cancer site. This work-up often includes a chest x-ray, CT scan of the chest, abdomen, and pelvis, or a mammogram. A PET scan may be performed.

If a suspicious site for primary cancer is identified, oftentimes that site is biopsied first to help direct treatment. If there is a prior history of cancer, a biopsy may not be necessary. If the primary cancer cannot be identified, then a brain biopsy or surgery to remove the tumor may be performed to determine the diagnosis.

## What treatments are available?

Treatment options vary depending on the patient's overall health, number and location of brain/spine lesions, location and severity of the primary cancer, and the type of primary cancer.

**Medications** may be used to relieve some of the side effects of brain tumors. These include steroids to reduce swelling and edema around the tumor, and anticonvulsants to prevent or control seizures.

## Radiation

Radiation therapy uses controlled high-energy rays to damage the DNA inside cells, making them unable to divide and grow. The goal of radiation therapy is to maximize the dose to abnormal cells and minimize exposure to normal cells (Fig. 2).

Pinpoint accuracy is critical so that the lethal dose is applied only to the tumor and not to surrounding healthy tissues. External beam radiation is delivered from outside the body by a machine that aims high-energy rays (x-rays, gamma rays) at the tumor. The two main radiosurgery technologies are the Leksell Gamma Knife and linear accelerator systems, such as the BrainLab Novalis. A head frame or facemask is attached to the patient's head to precisely localize the tumor on an MRI scan and to hold the head perfectly still during treatment. Types of radiation include:

- **Stereotactic radiosurgery (SRS)** delivers a high dose of radiation during a single session or 5 daily sessions. Although it is called surgery, no incision is made. Frames and masks are used to keep the patient immobile while beams are aimed at the tumor(s) (Fig 3).
- **Fractionated stereotactic radiotherapy** delivers lower doses of radiation over many visits. Patients return daily over several weeks to receive the complete radiation dose.

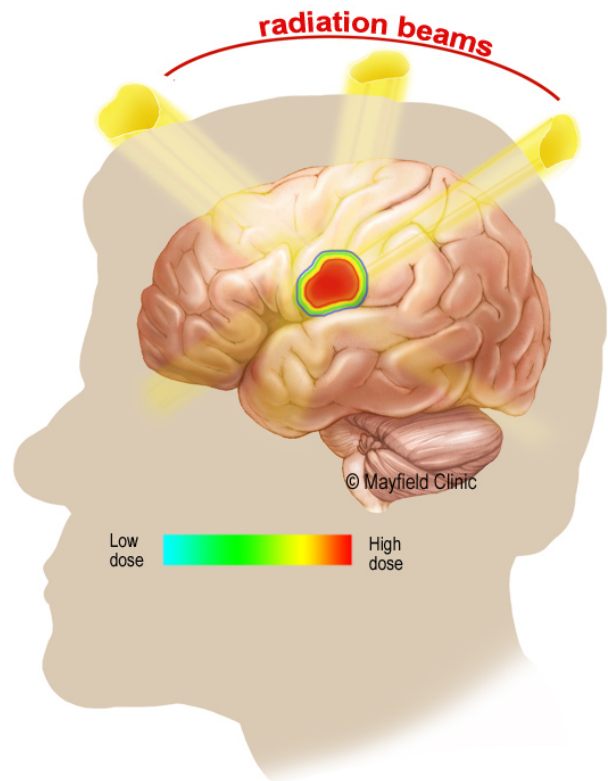


Figure 2. The radiation beams are shaped to match the tumor and minimize exposure to normal brain. Colored lines around the tumor indicate the radiation dose to the tissue.



Figure 3. During radiosurgery, the patient lies on the table with their head held perfectly still with either a head frame or facemask in the treatment field. This photo shows Gamma Knife radiosurgery delivered through 192 openings in the machine.

- **Whole brain radiotherapy (WBRT)** delivers the radiation dose to the entire brain, even to healthy tissue. It may be used to treat multiple brain metastases that are seen on the scan plus those that are microscopic and not yet visible.

Patients with smaller metastatic lesions (< 3 cm) can be treated with a single treatment (stereotactic radiosurgery). Patients with multiple metastatic lesions are treated with radiosurgery given in 5 daily sessions. Delivering a fraction of the total radiation dose gives normal cells time to repair themselves between treatments and may reduce side effects.

### Surgery

Surgery is typically recommended for patients who have 1 or 2 metastatic brain lesions and are in good health, with primary cancer that is treatable. To remove a brain tumor, a neurosurgeon performs a craniotomy to open the skull (Fig. 4). If the tumor is near critical areas of the brain, the surgeon may remove only part of it. A partial removal can still relieve symptoms. After the tumor is removed, the bone flap is replaced and secured to the skull with plates and screws. Radiation or chemotherapy may be used on the remaining tumor cells. Radiation seeds may be placed at the time of surgery to help prevent tumor recurrence.

Image-guided surgery technologies, tumor fluorescence, intraoperative MRI/CT, and functional brain mapping have improved the surgeon's ability to precisely locate the tumor, define the tumor's borders, avoid injury to vital brain areas, and confirm the amount of tumor removal while in the operating room.

### Chemotherapy

Chemotherapy drugs work by interrupting cell division. They can be given orally as a pill, intravenously (IV), or as a wafer placed surgically in the tumor cavity. Chemotherapy is delivered in cycles, with rest periods in between to allow the body to rebuild healthy cells. Unfortunately, chemotherapy given to treat cancer in the body (systemic) cannot pass through the blood-brain barrier. In cases of brain metastasis, the brain tumor must be treated differently than the primary cancer.

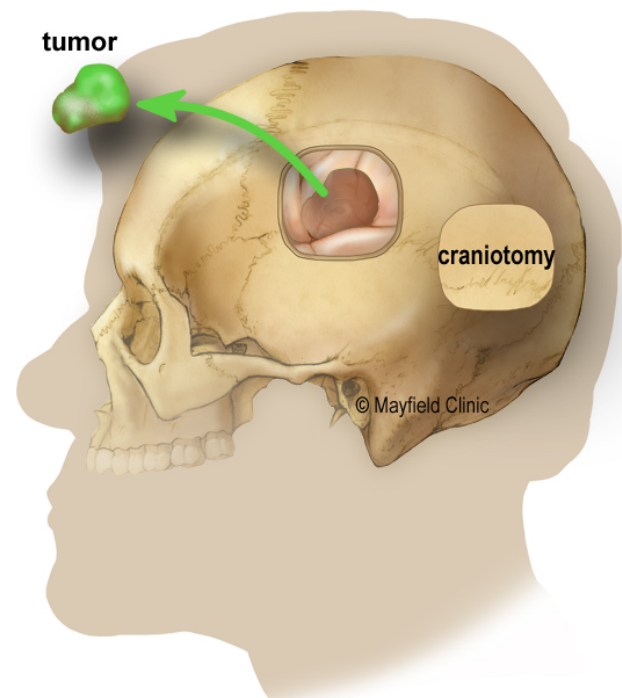


Figure 4. Surgery involves cutting a window in the skull (craniotomy) to remove the tumor.

Brain metastases from certain cancers are sensitive to targeted therapies that bind to tumor-specific receptors and work with your immune system (personalized medicine).

### Sources & links

If you have more questions, please contact Mayfield Brain & Spine at 800-325-7787 or 513-221-1100.

Support groups provides an opportunity for patients and their families to share experiences, receive support, and learn about advances in treatments and medications.

### Links

American Brain Tumor Association  
[www.abta.org](http://www.abta.org)

National Brain Tumor Society  
[braintumor.org](http://braintumor.org)



updated > 6.2018  
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