All About Brain Metastases

What are brain metastases?

Brain metastases are when cancer cells from your primary site (where the cancer started) spread to the brain. Brain metastases, often called “brain mets,” are more common than primary brain tumors (cancer that starts in the brain). Studies suggest brain metastases happen in about 10%-30% of patients with cancer.

Brain mets are different from a primary brain tumor (meaning a tumor that started in the brain). For example, lung cancer starts in the lung cells. These tumor cells can break off from the original mass in the lung. The lung cancer cells travel through the bloodstream or lymph system to other parts of the body, like the brain. This spreading of the tumor is known as “metastasis.” When lung cancer metastasizes to the brain, these mets are made of lung cancer cells.

You can have many brain metastases at the same time in different parts of the brain. Any cancer can spread to the brain. Brain mets are most common in lung cancer. Other cancers that often metastasize to the brain are melanoma, breast cancer, colon cancer, and renal cell (kidney) cancer.

There has been a rise in the number of brain metastases in recent years. This could be because we have better tools to diagnose brain metastases. People are living longer with metastatic disease due to advances in cancer treatments.

Signs, Symptoms, and Diagnosis

Common signs and symptoms of brain metastases are:

- Cognitive changes (changes in how your brain works like memory, attention, reasoning).
- Behavior/mood changes.
- Feeling unsteady, losing coordination or balance (having trouble walking).
- Vision changes.
- Aphasia (trouble finding words).
- Headache.
- Weakness.
- Seizures.

If you are having any of these symptoms, contact your care team right away.

If your provider thinks you may have brain mets, they will order imaging studies (MRI, CT scan) to look at your brain. You may need a biopsy if the primary cancer type is unknown or if there has been a long period of time between treatment for the initial primary cancer and your new symptoms.

Treatment Options

Treatment decisions for each patient are based on many factors, such as:

- Primary tumor type.
- How healthy you are.
- Age.
- Treatment you are receiving for your primary cancer.
- The number of brain metastases.
Each primary cancer acts and is treated differently. The treatment options for brain mets depend on your primary (original site) tumor type.

**Symptom Management**

Your skull is hard and meant to protect your brain. Inside your skull there is not much extra space. Brain metastases take up space in the brain, putting pressure on surrounding tissue. This pressure can cause symptoms. The first goal of therapy is to relieve some of this pressure by decreasing swelling. To do this, medications called corticosteroids are used (dexamethasone, prednisone). They can be given either orally (by mouth) or through an intravenous (IV) catheter. Some people have relief of symptoms soon after starting steroids. However, this does not mean the tumor is gone. You may also be given medication to treat or prevent seizures.

**Surgery**

Surgery can be used to treat one met (lesion), especially if the cancer is under control in the rest of your body. The lesion must be in an area of the brain where it is safe to operate. Studies have shown that patients with a single brain metastasis who had surgery followed by whole brain radiation therapy (WBRT) have fewer recurrences (when the cancer comes back) and better quality of life than patients treated with WBRT alone.

**Whole Brain Radiation Therapy**

Whole brain radiotherapy (WBRT) is radiation given to the entire brain. This is often given in 10 to 15 doses (also called fractions). WBRT is often used when surgery is not an option, or when there are more than 3 brain lesions. WBRT may also be used with radiosurgery. The whole brain is treated because there may be cancer cells in the normal-appearing brain, but not enough of them yet to form a mass or be seen by imaging studies. Treatment of the whole brain tries to kill all the cancer cells, even those that haven’t formed an actual met.

WBRT improves symptoms of brain metastases in 70-90% of patients, although some of this is also a result of the corticosteroids. Recurrence is common, and control of brain metastases may only happen in half of the patients. Patients with tumors that are more sensitive to the effects of radiation respond better (lung and breast, for example) than those with tumors that are less sensitive to radiation (melanoma and renal cancers).

**Stereotactic Radiosurgery (SRS)**

Stereotactic radiosurgery (SRS) is not surgery. It is a large dose of radiation to the tumor site given in a very precise way. Your head needs to be kept very still using a helmet or mask so that you don’t move during treatment. Metastases being treated with SRS should be 3 cm or smaller.

SRS is given in a single dose (Gamma Knife®) or up to five doses (Cyberknife®). More than one brain met can be treated during one session. For example, if you have 2 separate brain metastases, both could be treated on the same day. Treatments are given by a traditional radiation machine called a linear accelerator, or a specialized machine such as Gamma Knife®, Cyberknife®, XKnife® and ExacTrac®.

Gamma Knife® delivers several hundred beams of radiation from a cobalt source. The radiation beams concentrate at the point where all the beams meet (see picture). The radiation beams travel through hundreds of holes in the helmet. This lets a high dose of radiation to be delivered to the tumor while protecting the surrounding tissue from the high dose.

XKnife® is a linear accelerator-based treatment. Like Gamma Knife, a head frame is used, which will remain on for the entire treatment.

Cyberknife® is a form of frameless SRS using a specialized miniature linear accelerator with a robotic arm. Instead of using a frame to keep you still a custom mask is used for each patient along with skull-based tracking, allowing the robot to follow a target. Cyberknife® can also treat lesions larger than 3 cm and be used in other parts of the body.

Proton therapy is a newer form of SRS. Instead of using photons to target a met, protons are used to target the met. A machine called a synchrotron or cyclotron speeds up the protons, which are positively charged particles. The high energy of these
moving protons can kill cancer cells. During treatment, the protons can precisely target the tumor. Proton therapy is a growing field of radiation therapy.

Your care team will assess the best radiation option(s) for you and make a care plan based on your case.

**Chemotherapy**

It is believed that most chemotherapy medications are not able to cross the blood-brain barrier. They move through the bloodstream, but cannot enter the brain. As a result, the brain allows cancer cells to "escape" the chemo and make their way there. However, there are exceptions.

Researchers have found that brain metastases from tumor types that are sensitive to chemotherapy (for example testicular cancer, lymphomas, and small cell lung cancer) are also sensitive to chemotherapy. Research has also shown that people who have not had a large amount of chemotherapy in the past may have a greater reduction in brain metastases with chemotherapy treatment. This leads researchers to believe that some chemotherapies pass through the blood-brain barrier, just not always in effective amounts. One chemotherapy agent, temozolomide (Temodar®), is an oral medication that is capable of crossing the blood-brain barrier. It can be used to treat some brain mets.

More recently, studies show that chemotherapies such as targeted therapies and immunotherapies may be useful in treating brain metastases by treating the primary cancer. Researchers are studying biomarkers that can be measured in the patient or the tumor. Biomarkers can be used to determine if a treatment or chemotherapy will work to treat the cancer. This is often called "personalized medicine." This means the treatment is no longer just based on the cancer type, but is much more specific to the genetic make-up of your tumor. Much of this shift in treatment decisions is possible because of targeted therapies.

**Targeted** (also called "biologic") therapies are a class of medications that target certain genetic mutations in various cancers. These medications often produce very different side effects than standard chemotherapy and can be given alone or in combination with standard chemotherapy. There are many targeted therapies that can be used in the treatment of brain mets because they also target the original tumor. Some targeted therapies used in the treatment of brain mets include include lapatinib, erlotinib, gefitinib, and vemurafenib.

Immunotherapy medications can also be used. Immunotherapy is a way of treating cancer that uses the body’s own immune system to find and kill cancer cells. Ipilimumab, nivolumab, and pembrolizumab are immunotherapy medications used to treat various types of cancer. CAR-T therapy is also being studied in clinical trials as a treatment option for brain mets in some cancer types.

To learn more about your specific cancer type and their treatment use our cancer types menu.

**Preventing Brain Metastases with WBRT: Prophylactic Cranial Irradiation**

Whole brain radiation can be used to prevent brain metastases. This is called "prophylactic cranial irradiation" or "PCI." Studies of PCI have shown great decreases in brain mets (from 55% to 19% at 2 years and from 56% to 35% at 3 years) and increases in overall survival. There may be long-term neurologic issues but ee don’t know a lot about the long-term side effects of WBRT.

**Clinical Trials**

Clinical trials are extremely important in furthering our knowledge of this disease. It is through clinical trials that we know what we do today, and many exciting new therapies are currently being tested. Talk to your healthcare provider about participating in clinical trials in your area. You can also explore currently open clinical trials using the [OncoLink Clinical Trials Matching Service](http://www.oncolink.org)