Metastasis — A Primer

Metastatic cancer is cancer that has spread from the site where it first started to another place in the body.
It is the leading cause of cancer death.
Common targets of metastasis include the bone, liver, and lung.

1. What is metastatic cancer?
Metastatic cancer is cancer that has spread from the primary tumor to other places in the body. A tumor formed by metastatic cancer cells is called a metastatic tumor or a metastasis. The process by which cancer cells spread to other parts of the body is also called metastasis.

Metastatic cancer cells and cells of the original cancer usually have some molecular features in common, such as the expression of certain proteins or the presence of specific chromosome changes.

2. Can it be cured?
Although some types of metastatic cancer can be cured with current treatments, most cannot. The primary goal of most treatments is to control the growth of the cancer or to relieve symptoms caused by it. In some cases, metastatic cancer treatments may help prolong life. However, most people who die of cancer die of metastatic disease.

3. Can any type of cancer form a metastatic tumor?
Virtually all cancers can form metastatic tumors. Cancers of the blood, such as leukemia, are by their nature widespread or multifocal in origin.

4. What factors influence metastasis?
The ability of a cancer cell to metastasize successfully depends on its individual properties; the properties of the noncancerous cells, including immune system cells, present at the original location; and the properties of the cells it encounters in the lymphatic system or the bloodstream and at the final destination in another part of the body. Not all cancer cells, by themselves, have the ability to metastasize.

5. How does cancer spread?
Cancer cell metastasis usually involves the following steps:

- **Local invasion**: Cancer cells invade nearby normal tissue.
- **Intravasation**: Cancer cells invade and move through the walls of nearby lymph vessels or blood vessels.
- **Circulation**: Cancer cells move through the lymphatic system and the bloodstream to other parts of the body.
- **Arrest and extravasation**: Cancer cells arrest, or stop moving, in small blood vessels called capillaries at a distant location. They then invade the walls of the capillaries and migrate into the surrounding tissue (extravasation).
- **Proliferation**: Cancer cells multiply at the distant location to form small tumors known as micrometastases.
- **Angiogenesis**: Micrometastases stimulate the growth of new blood vessels to obtain a blood supply. A blood supply is needed to obtain the oxygen and nutrients necessary for continued tumor growth.

6. Where does cancer spread?
Although most cancers have the ability to spread to many different parts of the body, they usually spread to one site more often than others. Common sites of cancer metastasis include the bone, liver, and lung.
7. **What are the symptoms of metastatic cancer?**

Some people with metastatic tumors do not have symptoms. Their metastases are found by x-rays or other tests. When symptoms of metastatic cancer do occur, the type and frequency of the symptoms will depend on the size and location of the metastasis. Cancer that spreads to the bone is likely to cause pain and can lead to bone fractures. Cancer that spreads to the brain can cause a variety of symptoms, including headaches, seizures, and unsteadiness. Shortness of breath may be a sign of lung metastasis. Abdominal swelling or jaundice (yellowing of the skin) can indicate that cancer has spread to the liver.

Sometimes a person’s original cancer is discovered only after a metastatic tumor causes symptoms. For example, a man whose prostate cancer has spread to the bones in his pelvis may have lower back pain (caused by the cancer in his bones) before he experiences any symptoms from the original tumor in his prostate.

8. **Can someone have metastasis without having a primary cancer?**

No. A metastatic tumor is always caused by cancer cells from another part of the body.

In most cases, when a metastatic tumor is found first, the primary cancer can also be found. The search for the primary cancer may involve lab tests, x-rays, computed tomography (CT) scans, magnetic resonance imaging (MRI) scans, positron emission tomography (PET) scans, and other procedures. However, in some patients, a metastatic tumor is diagnosed but the primary tumor cannot be found. Doctors refer to the primary cancer as unknown or occult (hidden), and the patient is said to have cancer of unknown primary origin (CUP).

9. **What treatments are used for metastatic cancer?**

Metastatic cancer may be treated with systemic therapy (chemotherapy, biological therapy, targeted therapy, hormonal therapy), local therapy (surgery, radiation therapy), or a combination of these treatments. The choice of treatment generally depends on the type of primary cancer; the size, location, and number of metastatic tumors; the patient’s age and general health; and the types of treatment the patient has had in the past. In patients with CUP, it is possible to treat the disease even though the primary cancer has not been found.

10. **Are new treatments for metastatic cancer being developed?**

Yes, researchers are studying new ways to kill or stop the growth of primary cancer cells and metastatic cancer cells, including new ways to boost the strength of immune responses against tumors. In addition, researchers are trying to find ways to disrupt individual steps in the metastatic process.

Before any new treatment can be made widely available to patients, it must be studied in clinical trials (research studies) and found to be safe and effective in treating disease. Many organizations, including drug companies, sponsor clinical trials that take place at hospitals, universities, medical schools, and cancer centers around the country. Clinical trials are a critical step in testing new therapies and improving cancer care. The information gained from clinical trials leads to progress not only in the treatment of cancer but also in the detection, diagnosis, and prevention of the disease.

11. **What is “oligometastasis”?**

In 1994, physician-scientists from the University of Chicago proposed that there was an intermediate state between cancer that had not spread at all and cancer that had spread extensively. They named this phenomenon "oligometastasis," meaning cancer that had spread to a few distant sites. They subsequently demonstrated that some patients with oligometastases could be cured with therapies – such as surgery or radiotherapy – that are directed locally at the metastases. They continue to refine and develop this novel approach.