

Metastasis is a pathogenic agent's spread from an initial or primary site to a different or secondary site within the host's body.

The newly pathological sites, then, are metastases.

Cancer occurs after cells are genetically altered to proliferate rapidly and indefinitely.

This uncontrolled proliferation by mitosis produces a primary heterogeneous tumor.

The cells which constitute the tumor eventually undergo metaplasia, followed by dysplasia then anaplasia, resulting in a malignant phenotype.

This malignancy allows for invasion into the circulation, followed by invasion to a second site for tumorigenesis.

Some cancer cells known as circulating tumor cells acquire the ability to penetrate the walls of lymphatic or blood vessels, after which they are able to circulate through the bloodstream to other sites and tissues in the body.

This process is known (respectively) as a lymphatic or hematogenous spread.

After the tumor cells come to rest at another site, they re-penetrate the vessel or walls and continue to multiply, eventually forming another clinically detectable tumor.

This new tumor is known as a metastatic (or secondary) tumor.

Metastasis is one of the hallmarks of cancer, distinguishing it from benign tumors.

Most cancers can metastasize, although in varying degrees.

Basal cell carcinoma for example rarely metastasizes.

When tumor cells metastasize, the new tumor is called a secondary or metastatic tumor, and its cells are similar to those in the original or primary tumor.

This means that if breast cancer metastasizes to the lungs, the

secondary tumor is made up of abnormal breast cells, not of abnormal lung cells.

The tumor in the lung is then called metastatic breast cancer, not lung cancer.

Metastasis is a key element in cancer staging systems such as the TNM staging system.

In overall stage grouping, metastasis places a cancer in Stage IV.

The possibilities of curative treatment are greatly reduced, or often entirely removed when the cancer has metastasized.

Signs and symptoms

Initially, nearby lymph nodes are struck early.

The lungs, liver, brain, and bones are the most common metastasis locations from solid tumors.

In lymph nodes, a common symptom is a lymphadenopathy

Lungs: a cough, hemoptysis, and dyspnea (shortness of breath)

Liver: hepatomegaly (enlarged liver), nausea and jaundice

Bones: bone pain, fracture of affected bones

Brain: neurological symptoms such as headaches, seizures, and vertigo

Although advanced cancer may cause pain, it is often not the first symptom.

Some patients, however, do not show any symptoms. When the organ gets a metastatic disease it begins to shrink until its lymph nodes burst, or undergo lysis.

Pathophysiology

Metastatic tumors are very common in the late stages of cancer. The spread of metastasis may occur via the blood or the lymphatics or through both routes.

The most common places for the metastases to occur are the lungs, liver, brain, and the bones.

Factors involved

Metastasis involves a complex series of steps in which cancer cells leave the original tumor site and migrate to other parts of the body via the bloodstream, via the lymphatic system, or by direct extension.

Breast cancer, for example, tends to metastasize to the bones and lungs.

Routes

Metastasis occurs by the following four routes:

Transcoelomic

The spread of a malignancy into body cavities can occur via penetrating the

surface of the peritoneal, pleural, pericardial, or subarachnoid spaces.

For example, ovarian tumors can spread transperitoneally to the surface of the liver.

Lymphatic spread

Lymphatic spread allows the transport of tumor cells to regional lymph nodes near the primary tumor and ultimately, to other parts of the body. This is called nodal involvement, positive nodes, or regional disease.

It is common medical practice to test by biopsy at least one lymph node near a tumor site when carrying out surgery to examine or remove a tumor.

This lymph node is then called a sentinel lymph node. Lymphatic spread is the most common route of initial metastasis for carcinomas.

Hematogenous spread

This is the typical route of metastasis for sarcomas, but it is also the favored route for certain types of carcinoma, such as renal cell carcinoma originating in the kidney.

Because of their thinner walls, veins are more frequently invaded than are arteries, and metastasis tends to follow the pattern of venous flow.

For example, colorectal cancer spreads primarily through the portal vein to the liver.

Canalicular spread

Some tumors, especially carcinomas may metastasize along anatomical canalicular spaces. These spaces include for example the bile ducts, the urinary system, the airways and the subarachnoid space.

Organ-specific targets

There is a propensity for certain tumors to seed in particular organs.

For example, prostate cancer usually metastasizes to the bones.

In a similar manner, colon cancer has a tendency to metastasize to the liver.

Stomach cancer often metastasizes to the ovary in women.

Diagnosis

The cells in a metastatic tumor resemble those in the primary tumor.

Once the cancerous tissue is examined under a microscope to determine the cell type, a doctor can usually tell whether that type of cell is normally found in the part of the body from which the tissue sample was taken.

For instance, breast cancer cells look the same whether they are found in the breast or have spread to another part of the body.

So, if a tissue sample taken from a tumor in the lung contains cells that look like breast cells, the doctor determines that the lung tumor is a secondary tumor.

Metastatic cancers may be found at the same time as the primary tumor, or months or years later.

When a second tumor is found in a patient that has been treated for cancer in the past, it is more often a metastasis than another primary tumor.

Management

Treatment and survival is determined, to a great extent, by whether or not a cancer remains

localized or spreads to other locations in the body.

If the cancer metastasizes to other tissues or organs, it usually increases a patient's likelihood of death.

Some cancers—such as some forms of leukemia, a cancer of the blood, or malignancies in the brain—can kill without spreading at all.

Once a cancer has metastasized it may still be treated with radiosurgery, chemotherapy, radiation therapy, biological therapy, hormone therapy, surgery, or a combination of these interventions ("multimodal therapy").

The choice of treatment depends on a large number of factors, including the

type of primary cancer, the size and location of the metastases, the patient's age and general health, and the types of treatments used previously.

Current treatments are rarely able to cure metastatic cancer though some tumors, such as testicular cancer and thyroid cancer, are usually curable.

Palliative care or care aimed at improving the quality of life of people with major illness, has been recommended as part of management programs for metastasis.

Research

Although metastasis is widely accepted to be the result of the tumor

cells migration, there is a hypothesis saying that some metastases are the result of inflammatory processes by abnormal immune cells.