A **brain tumor**, or tumour, is an intracranial solid neoplasm, a tumor (defined as an *abnormal growth of cells*) within the brain or the central spinal canal.

Brain tumors include all tumors inside the cranium or in the central spinal canal. They are created by an abnormal and uncontrolled cell division, usually in the brain itself, but also in lymphatic tissue, in blood vessels, in the cranial nerves, in the brain envelopes (meninges), skull, pituitary gland, or pineal gland. Within the brain itself, the involved cells may be neurons or glial cells (which include astrocytes, oligodendrocytes, and ependymal cells). Brain tumors may also spread from cancers primarily located in other organs (metastatic tumors).

Any brain tumor is inherently serious and life-threatening because of its invasive and infiltrative character in the limited space of the intracranial cavity. However, brain tumors (even malignant ones) are not invariably fatal, especially lipomas which are inherently benign. Brain tumors or intracranial neoplasms can be cancerous (malignant) or non-cancerous (benign); however, the definitions of malignant or benign neoplasms differs from those commonly used in other types of cancerous or non-cancerous neoplasms in the body. Its threat level depends on the combination of factors like the type of tumor, its location, its size and its state of development. Because the brain is well protected by the skull, the early detection of a brain tumor occurs only when diagnostic tools are directed at the intracranial cavity. Usually detection occurs in advanced stages when the presence of the tumor has caused unexplained symptoms.

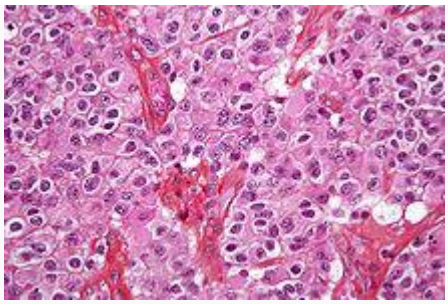
Primary (true) brain tumors are commonly located in the posterior cranial fossa in children and in the anterior two-thirds of the cerebral hemispheres inadults, although they can affect any part of the brain.

Cause

Aside from exposure to vinyl chloride or ionizing radiation, there are no known environmental factors associated with brain tumors. Mutations and deletions of so-called tumor suppressor genes are thought to be the cause of some forms of brain tumors. People with various inherited diseases, such as Von Hippel-Lindau syndrome, multiple endocrine neoplasia, neurofibromatosis type 2 are at high risk of developing brain tumors.

Although studies have not shown any link between cell phone radiation and brain tumors,[2] the World Health Organization has classified mobile phone radiation on the IARC scale into Group 2B – possibly carcinogenic. That means that there "could be some risk" of carcinogenicity, so additional research into the long-term, heavy use of mobile phones needs to be conducted.[3]

Pathology



Micrograph of an oligodendroglioma, a type of brain cancer. Brain biopsy. H&E stain.

Tumors have characteristics that allow determination of its malignacy, how it will evolve and it will allow the medical team to determine the management plan.

Anaplasia: or dedifferentiation; loss of differentiation of cells and of their orientation to one another and blood vessels, a characteristic of anaplastic tumor tissue. Anaplastic cells have lost total control of their normal functions and many have deteriorated cell structures. Anaplastic cells often have abnormally high nuclear-to-cytoplasmic ratios, and many are multinucleated. Additionally, the nuclei of anaplastic cells are usually unnaturally shaped or oversized nuclei. Cells can become anaplastic in two ways: neoplastic tumor cells can dedifferentiate to become anaplasias (the dedifferentiation causes the cells to lose all of their normal structure/function), or cancer stem cells can increase in their capacity to multiply (i.e., uncontrollable growth due to failure of differentiation).

Atypia: is an indication of abnormality of a cell (which may be indicative for malignancy). Significance of the abnormality is highly dependent on context.

Neoplasia: is the (uncontrolled) division of cells; as such neoplasia is not problematic but its consequences are: the uncontrolled division of cells means that the mass of a neoplasm increases in size, and in a confined space such as the intracranial cavity this quickly becomes problematic because the mass invades the space of the brain pushing it aside, leading to compression of the brain tissue and increased intracranial pressure and destruction ofbrain parenchyma. Increased Intracranial pressure (ICP) may be attributable to the direct mass effect of the tumor, increased blood volume, or increased cerebrospinal fluid (CSF) volume may in turn have secondary symptoms

Necrosis: is the (premature) death of cells, caused by external factors such as infection, toxin or trauma. Necrotic cells send the wrong chemical signals which prevents phagocytes from disposing of the dead cells, leading to a build up of dead tissue, cell debris and toxins at or near the site of the necrotic cells[8]

Arterial and venous hypoxia, or the deprivation of adequate oxygen supply to certain areas of the brain, occurs when a tumor makes use of nearby blood vessels for its supply of blood and the neoplasm enters into competition for nutrients with the surrounding brain tissue.

More generally a neoplasm may cause release of metabolic end products (e.g., free radicals, altered electrolytes, neurotransmitters), and release and recruitment of cellular mediators (e.g., cytokines) that disrupt normal parenchymal function.

[edit]Classification

[edit]Secondary brain tumors

Secondary tumors of the brain are metastatic tumors that invaded the intracranial sphere from cancers originating in other organs. This means that a cancerous neoplasm has developed in another organ elsewhere in the body and that cancer cells have leaked from that primary tumor and then entered the lymphatic system and blood vessels. These are most common among brain tumors. In the United States there are about 170,000 new cases every year.[9] They then circulate through the bloodstream, and are deposited in the brain. There, these cells continue growing and dividing, becoming another invasive neoplasm of the primary cancer's tissue. Secondary tumors of the brain are very common in the terminal phases of patients with an incurable metastasized cancer; the most common

types of cancers that bring about secondary tumors of the brain are lung cancer, breast cancer, malignant melanoma, kidney cancer and colon cancer (in decreasing order of frequency).

Secondary brain tumors are the most common cause of tumors in the intracranial cavity.

The skull bone structure can also be subject to a neoplasm that by its very nature reduces the volume of the intracranial cavity, and can damage the brain.

[edit]By behavior

Brain tumors or intracranial neoplasms can be cancerous (malignant) or non-cancerous (benign). However, the definitions of malignant or benign neoplasms differs from those commonly used in other types of cancerous or non-cancerous neoplasms in the body. In cancers elsewhere in the body, three malignant properties differentiate benign tumors from malignant forms of cancer: benign tumors are self-limited and do not invade or metastasize. Characteristics of malignant tumors include:

- uncontrolled mitosis (growth by division beyond the normal limits)
- anaplasia: the cells in the neoplasm have an obviously different form (in size and shape). Anaplastic cells display marked pleomorphism. The cell nuclei are characteristically extremely hyperchromatic (darkly stained) and enlarged; the nucleus might have the same size as the cytoplasm of the cell (nuclear-cytoplasmic ratio may approach 1:1, instead of the normal 1:4 or 1:6 ratio). Giant cells – considerably larger than their neighbors – may form and possess either one enormous nucleus or several nuclei (syncytia). Anaplastic nuclei are variable and bizarre in size and shape.
- invasion or infiltration (medical literature uses these terms as synonymous equivalents. However, for clarity, the articles that follow adhere to a convention that they mean slightly different things; this convention is not followed outside these articles):
    - Invasion or invasiveness is the spatial expansion of the tumor through uncontrolled mitosis, in the sense that the neoplasm invades the space occupied by adjacent tissue, thereby pushing the other tissue aside and eventually compressing the tissue. Often these tumors are associated with clearly outlined tumors in imaging.
    - Infiltration is the behavior of the tumor either to grow (microscopic) tentacles that push into the surrounding tissue (often making the outline of the tumor undefined or diffuse) or to have tumor cells "seeded" into the tissue beyond the circumference of the tumorous mass; this does not mean that an infiltrative tumor does not take up space or does not compress the surrounding tissue as it grows, but an infiltrating neoplasm makes it difficult to say where the tumor ends and the healthy tissue starts.
- metastasis (spread to other locations in the body via lymph or blood).

Of the above malignant characteristics, some elements do not apply to primary neoplasms of the brain:

- Primary brain tumors rarely metastasize to other organs; some forms of primary brain tumors can metastasize but will not spread outside the intracranial cavity or the central spinal canal. Due to the blood–brain barrier cancerous cells of a primary neoplasm cannot enter the bloodstream and get carried to another location in the body. (Occasional isolated case reports suggest spread of certain brain tumors outside the central nervous system, e.g. bone metastasis of glioblastoma multiforme.[10])

- Primary brain tumors generally are invasive (i.e. they will expand spatially and intrude into the space occupied by other brain tissue and compress those brain tissues), however some of the more malignant primary brain tumors will infiltrate the surrounding tissue.

Of numerous grading systems in use for the classification of tumor of the central nervous system, the World Health Organization (WHO) grading system is commonly used for astrocytoma. Established in 1993 in an effort to eliminate confusion regarding diagnoses, the WHO system established a four-tiered histologic grading guideline for astrocytomas that assigns a grade from 1 to 4, with 1 being the least aggressive and 4 being the most aggressive.