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Review Article

Overview of brain cancer, its symptoms, diagnosis and treatment

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ABSTRACT

Brain cancer, also known as intracranial neoplasms, represents a group of malignant tumors that originate within the brain or its surrounding tissues. This article provides overview of brain cancer, focusing on its epidemiology, etiology, pathogenesis, clinical presentation, diagnostic approaches, and treatment modalities. The epidemiological data highlights the incidence, prevalence, and risk factors associated with brain cancer, emphasizing the importance of early detection and monitoring. Brain tumors are intracranial tumours that occupy skull space. Brain tumors are a relatively rare but lethal malignancy that presents difficulties in determining risk factors in the community. Because of their protected location in the brain, these tumors are intrinsically difficult to cure, with surgery, radiation, and chemotherapy therapies possibly resulting in long-term morbidity for patients and inadequate tumor cure. Because the space inside the skull is limited, brain tumors are dangerous because their growth raises intracranial pressure and can induce edema, restricted blood flow, and displacement, with subsequent degeneration, of healthy tissue that regulates important processes. In fact, brain tumors are the second largest cause of cancer fatalities in children and young people. Methods of prevention are being developed.

1. Introduction

1.1. Brain tumour

A brain tumor is a mass or development of aberrant brain cells. There are many distinct forms of brain tumors, some of which are noncancerous (benign) and others of which are cancerous (malignant).[1] The brain is the human body's most round organ. They govern every critical action of the human body, including emotions, movement, speech, and memory.[2] Because of its increased soft tissue contrast, magnetic resonance imaging (MRI) has become the primary non-invasive technology for brain tumor diagnosis during the previous few decades.[3] Glioma is a broad word for a primary brain tumor. It is a cancerous tumor of the nervous system's glial tissue. These are the most common (anaplastic, astrocytoma, and glioblastoma).[4]

Around 1,50,000 patients with cancer are affected brain tumor every year. The Glioblastoma multiform (GBM) is rare tumor with globule incidence of less than 10per 100,000 people its poor prognosis with survival rate of 14-15 months. The 2.5% death from cancer in person 15to34 years of age 1960 more than 116 cases of GBM have been reported. Adult primary tumors of CNS are rare with incidence 7.0 per 100,000 person years in EUROPE. First brain tumor patient is found to be 25 November 1884. First brain tumor operation successful in 1937. Worldwide estimated 30,8102 people of brain tumor in 2020. The highest brain cancer in world belonged Latvia incontinently Europe. The brain tumor patient of 2018 is there are 18,078,957. In cases of deaths attributable to global cancer in 2018 which 241,037 (2.71%).[5] The lowest incidence in

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Oceania (2438 cases,0.82).

Cancer refers to a group of diseases characterized by the uncontrolled growth and spread of abnormal cells in the body. These cells can form tumors or affect the functioning of organs and tissues. There are many types of cancer, and each may behave differently and require specific treatments. Common types of cancer include breast cancer, lung cancer, prostate cancer, colorectal cancer, and skin cancer, among others. Cancer can occur in any part of the body and can affect people of all ages, though it becomes more common with advancing age. Risk factors for cancer can include genetic factors, exposure to carcinogens (such as tobacco smoke or UV radiation), certain lifestyle choices (e.g., poor diet, lack of physical activity), and environmental factors. Early detection and treatment can significantly improve the prognosis for many cancers.[6]

Treatment options for cancer vary based on the type and stage of the disease. Common treatments include surgery, chemotherapy, radiation therapy, immunotherapy, and targeted therapy. In recent years, significant progress has been made in cancer research and treatment, leading to improved survival rates and better quality of life for many cancer patients. It is essential to consult with medical professionals if you have concerns about cancer, including symptoms, risk factors, prevention strategies, and potential treatment options. Regular screenings and maintaining a healthy lifestyle can also help reduce the risk of developing certain types of cancer.[7]

2. Brain Tumor Types

There are more than 120 different types of brain tumors, which differentiate by where they are occur and what kind of cells they are made of. Certain types of tumors are typically benign, while others are typically malignant. Brain cancer, also known as brain tumors, refers to the abnormal growth of cells in the brain. These tumors can be benign (non-cancerous) or malignant (cancerous). Brain cancer can originate from brain tissue itself (primary brain tumors) or can be a result of cancer spreading from other parts of the body (metastatic brain tumors).[8] Primary brain tumors are classified based on the type of cells they arise from and their location within the brain. Some common types of primary brain tumors include:

2.1. Primary brain tumors

A primary brain tumor is generally starts in the brain. It is often described as “low grade” or “high grade”. A low-grade tumor grows slowly, but it can turn into high grade tumor. A highgrade tumor grow faster. The secondary brain tumors are much more common than primary tumors.

2.2. Secondary brain tumors

A secondary brain tumor is a cancerous tumor that start in another part of the body, such as the breast, lung, or colon, and then spread to the brain.

1. *Gliomas:* Tumors that develop from glial cells, which support and nourish nerve cells. Gliomas include glioblastoma multiforme (GBM), astrocytoma, oligodendroglioma, and ependymoma.
2. *Meningiomas:* Tumors that form in the meninges, the protective membranes surrounding the brain and spinal cord.
3. *Pituitary adenomas:* Tumors that develop in the pituitary gland, which controls various hormonal functions in the body. Symptoms of brain cancer can vary depending on the tumor’s location and size but may include headaches, seizures, memory problems, changes in vision or hearing, difficulty with balance and coordination, and personality changes. The prognosis for brain cancer varies depending on several factors, including the tumor type, its location, and the overall health of the patient. Some brain tumors can be challenging to treat due to their location and the potential for affecting critical brain functions.

If you or someone you know is experiencing symptoms or has been diagnosed with brain cancer, it is essential to work closely with a team of medical specialists, including neurologists, neurosurgeons, oncologists, and other healthcare professionals, to determine the best treatment plan and support care. Early diagnosis and treatment can improve the outcome and quality of life for individuals with brain cancer.[9]

3. Global Statistic of Brain Cancer

As of my last update in September 2021, brain cancer is a significant health concern globally, but its incidence and prevalence can vary across different regions and populations. It is important to note that statistics may have changed since my last update, so for the most current data, it is best to refer to reputable sources like the World Health Organization (WHO), the American Cancer Society (ACS), or other cancer registries and health organizations.

Here are some general global statistics on brain cancer as of 2021:

1. *Incidence:* Brain cancer accounts for approximately 2% of all cancer cases worldwide.
2. *Mortality:* Brain cancer is responsible for about 2.5% of all cancer-related deaths globally.
3. *Age Group:* Brain cancer can occur at any age, but it is more common in older adults. The risk of brain cancer tends to increase with age.
4. *Survival Rates:* Survival rates for brain cancer can vary widely depending on factors such as the type of

tumor, its grade, and the stage at diagnosis. Generally, survival rates for brain cancer tend to be lower than some other types of cancer due to the complexities of treating tumors within the brain.

5. *Risk Factors:* While the exact causes of brain cancer are not fully understood, certain risk factors may increase the likelihood of developing brain tumors. These risk factors can include exposure to ionizing radiation, certain genetic syndromes, and a family history of brain cancer.
6. *Types of Tumors:* Brain cancer includes various types of tumors, such as gliomas (e.g., glioblastoma multiforme), meningiomas, pituitary adenomas, and medulloblastomas, among others. Each type has different characteristics and treatment approaches.

It is crucial to remember that brain cancer is a complex and diverse group of diseases, and individual cases can vary significantly. Improving brain cancer outcomes requires ongoing research, early detection, access to quality healthcare, and advancements in treatment options.

For the latest and most accurate statistics on brain cancer, I recommend consulting recent reports and data from reputable organizations like the World Health Organization or national cancer registries.[10]

4. Symptoms of Brain Cancer

The symptoms of brain cancer can vary depending on the location of the tumor within the brain and its size. Some common symptoms of brain cancer include:

1. *Headaches:* Persistent and severe headaches that may worsen over time. These headaches may be more intense in the morning or upon waking up.
2. *Seizures:* Uncontrolled electrical activity in the brain that can lead to seizures. Seizures can range from mild to severe and may involve convulsions or loss of consciousness.
3. *Cognitive changes:* Memory problems, difficulty concentrating, confusion, changes in judgment, and personality changes.
4. *Vision problems:* Blurred vision, double vision, or loss of peripheral vision.
5. *Speech difficulties:* Slurred speech, difficulty finding the right words, or trouble understanding speech.
6. *Weakness or paralysis:* Gradual or sudden weakness in the arms or legs, often on one side of the body.
7. *Balance and coordination issues:* Problems with walking, loss of balance, or difficulty coordinating movements.
8. *Nausea and vomiting:* Especially when associated with other symptoms like headaches or changes in vision.
9. *Sensory changes:* Numbness, tingling, or reduced sensation in the arms or legs.
10. *Behavioral changes:* Irritability, mood swings, depression, or other unexplained changes in behavior.

It is important to note that these symptoms can also be caused by various other conditions, and experiencing one or more of these symptoms does not necessarily mean a person has brain cancer. However, if you or someone you know is experiencing persistent or worsening symptoms, it is crucial to seek medical attention promptly. A healthcare professional can conduct a thorough evaluation, including neurological exams and imaging tests (such as MRI or CT scans), to determine the cause of the symptoms and, if necessary, make an accurate diagnosis of brain cancer or any other underlying condition. Early diagnosis and intervention can significantly impact the treatment and management of brain cancer.[11]

5. Diagnosis of Brain Cancer

The diagnosis of brain cancer typically involves a series of medical evaluations and tests performed by healthcare professionals, including neurologists, neurosurgeons, oncologists, and radiologists. The diagnostic process may include the following steps:

1. *Medical History:* The doctor will start by taking a detailed medical history, including any symptoms you are experiencing, their duration, and any relevant past medical conditions or family history.
2. *Physical Examination:* A thorough neurological examination will be conducted to assess cognitive function, reflexes, coordination, and sensory abilities.
3. *Imaging Tests:* Imaging techniques are crucial in identifying and locating brain tumors. Common imaging tests used include:
   (a) *Magnetic Resonance Imaging (MRI):* This provides detailed images of the brain and can reveal the size, location, and characteristics of the tumor.
   (b) *Computed Tomography (CT) Scan:* A CT scan uses X-rays to create cross-sectional images of the brain, helping to identify abnormalities.
4. *Biopsy:* If a tumor is detected, a biopsy may be performed to determine whether the tumor is cancerous (malignant) or non-cancerous (benign). A small sample of the tumor is taken and examined under a microscope by a pathologist.
5. *Lumbar Puncture (Spinal Tap):* In some cases, a lumbar puncture may be performed to check for cancer cells or other abnormalities in the cerebrospinal fluid, which surrounds the brain and spinal cord.
6. *Molecular Testing:* Some brain tumors may undergo molecular testing to identify specific genetic or molecular markers. This information can help guide

treatment decisions, especially for certain types of brain cancer.

7. *Neurological Tests:* Depending on the tumor's location and symptoms, additional neurological tests may be conducted to assess specific functions affected by the tumor.

Once the diagnosis of brain cancer is confirmed, the medical team will determine the type of brain tumor, its grade (a measure of how aggressive the tumor is), and its stage (extent of spread within the brain or to other parts of the body). This information is essential for developing an appropriate treatment plan, which may involve surgery, radiation therapy, chemotherapy, immunotherapy, or a combination of these approaches. It is essential to work closely with a team of medical professionals specializing in brain cancer to ensure accurate diagnosis, comprehensive evaluation, and the most effective treatment approach for the specific type and stage of the brain tumor.

6. Treatment of Brain Cancer

The treatment of brain cancer depends on various factors, including the type of brain tumor, its size, location, grade (how aggressive it is), and the patient's overall health. The treatment approach often involves a multidisciplinary team of healthcare professionals, including neurologists, neurosurgeons, radiation oncologists, medical oncologists, and supportive care specialists. The primary treatment options for brain cancer include:

1. *Surgery:* Surgical removal of the tumor is often the initial treatment for accessible brain tumors. The neurosurgeon aims to remove as much of the tumor as possible without causing damage to critical brain structures. In some cases, complete removal may not be possible due to the tumor's location or the risk of neurological damage.
2. *Radiation Therapy:* Radiation therapy uses high-energy beams to target and destroy cancer cells or shrink tumors. It may be used as the primary treatment for tumors that are inoperable or as an adjuvant therapy after surgery to target any remaining cancer cells.
3. *Chemotherapy:* Chemotherapy Chemotherapy drugs work by interrupting cell division. However, it affects not only tumor cells but normal cells, thus causing side effects, especially in fast growing cells (e.g., hair, digestive, blood). Treatment is delivered in cycles with rest periods in between to allow the body to rebuild healthy cells. Chemotherapy drugs can be administered orally as a pill, intravenously (IV), or as a wafer placed surgically into the tumor. The drugs most commonly used to treat brain tumors are carmustine (BCNU), lomustine (CCNU), and temozolomide (Temodar). Chemotherapy is also used as a radio-sensitizing agent that increases tumor cell death during radiation therapy. Agents that often work in high-grade gliomas include procarbazine, platinum analogs (cisplatin, carboplatin), the nitrosureas (BCNU, CCNU), and alkylating agents (temozolomide, vincristine). BCNU has been proven effective when applied locally to the tumor bed after the tumor has been removed. By applying it directly to the diseased area of the brain, side effects are limited and the drug has a more beneficial effect. Chemotherapy is not routinely used for benign tumors.
4. *Targeted Therapy:* Targeted therapy utilizes drugs that specifically target certain molecules involved in cancer growth. This approach is used for specific types of brain tumors with identifiable molecular markers.
5. *Immunotherapy:* Immunotherapy aims to boost the body's immune system to recognize and attack cancer cells. It is an emerging treatment option for some types of brain cancer and is still under investigation in clinical trials.
6. *Stereotactic Radiosurgery:* This precise and focused radiation treatment is used for smaller tumors or lesions that are challenging to access surgically. It delivers a high dose of radiation directly to the tumor while minimizing exposure to surrounding healthy tissue.
7. *Supportive Care:* Managing symptoms and providing supportive care is an essential part of brain cancer treatment. Supportive care may include pain management, medications to control seizures or reduce swelling, physical therapy, occupational therapy, and speech therapy.

   The treatment plan for each patient is personalized, and the combination of treatments chosen will depend on the specific characteristics of the tumor and the patient's overall health. Additionally, clinical trials may offer opportunities to access novel treatments and therapies that are still being evaluated for their effectiveness in treating brain cancer. Brain cancer treatment is often challenging, and the prognosis varies depending on several factors. Regular follow-up care and monitoring are essential to detect any recurrence or potential side effects of treatment. It is crucial for patients to have open communication with their healthcare team and to explore all available treatment options to make informed decisions about their care.[12]

7. Precautions During Brain Cancer

If you or someone you know has been diagnosed with brain cancer, it's essential to take certain precautions to ensure the best possible outcome and overall well-being. These precautions may include:

1. *Follow the Treatment Plan:* Adhere to the treatment plan recommended by your healthcare team, including

surgery, radiation therapy, chemotherapy, or other prescribed therapies. Consistency in following the treatment regimen is crucial for the effectiveness of the treatments.

2. *Attend Regular Medical Check-ups:* Attend all scheduled follow-up appointments with your medical team. Regular check-ups and monitoring are necessary to track the progress of the treatment and detect any potential complications or recurrence early.
3. *Manage Symptoms:* Work closely with your healthcare team to manage symptoms, such as headaches, seizures, or neurological changes. Medications and other interventions can help alleviate these symptoms and improve your quality of life.
4. *Take Medications as Prescribed:* If your doctor prescribes medications, take them as directed and do not skip doses. Some medications, such as anticonvulsants or corticosteroids, may be necessary to control symptoms and reduce inflammation.
5. *Monitor Cognitive Function:* Pay attention to any changes in cognitive function, memory, or other neurological symptoms. Inform your healthcare team about any new or worsening cognitive issues.
6. *Safety Measures:* Depending on the symptoms and possible side effects of treatment, take safety measures to prevent falls or accidents. For example, install handrails in the bathroom and use non-slip mats on slippery surfaces.
7. *Healthy Diet:* Maintain a balanced and nutritious diet to support your overall health and well-being. A well-balanced diet can help optimize your body's ability to cope with treatment and promote healing.
8. *Physical Activity:* Engage in physical activities as recommended by your healthcare team. Exercise can help improve your strength, stamina, and mood.

8. Emotional Support

Seek emotional support from family, friends, or support groups. Coping with brain cancer can be challenging, and having a strong support system can make a significant difference.

9. Avoid Stress

Try to reduce stress as much as possible through relaxation techniques, meditation, or other stress-reducing activities. Chronic stress can negatively impact the immune system and overall health.

10. Sun Protection

If you are receiving radiation therapy, take precautions to protect your scalp and any exposed skin from the sun during treatment.

11. Avoid Alcohol and Tobacco

Avoid alcohol and tobacco products, as they can interfere with treatment and overall health. Remember that every individual's situation is unique, so the precautions may vary based on your specific condition and treatment plan. Always consult your healthcare team to get personalized advice and guidance on managing brain cancer and ensuring the best possible care and outcomes.[13–15]

12. Conclusion

In this paper, we have proposed the information regarding the brain tumor, its types, symptoms, diagnosis, and treatment. This review has been done to focus on future development of medical image processing in health care and medicine.

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14. Conflict of Interest

None.

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References

1. American Cancer Society. Brain and Spinal Cord Cancers of Adults. ; 1999. Available from: http://www3.cancer.org/cancerinfo/.
2. Carrie AM, Timothy FC. Brain tumor treatment: chemotherapy and other new developments. *Semin Oncol Nurs*. 2004;20(4):260–72.
3. Bowers DC, Liu Y, Leisenring W, Mcneil E, Stovall M, Gurney JG. Late-occuring stroke Among long-term survivuors of childhood leukemia and brain tumors: a report from the childhood Cancer Survivors study. *J Clin oncol*. 2006;24(33):5277–82.
4. Buckner JC, Brown PD, Neill O, Meyer BP, Wetmore FB, Uhm CJ. Central nrvous system tumors. *Mayo Clin Proc*. 2007;82(10):1271–86.
5. Bunin G. What causes childhood brain tumors? Limited knowledge, many clues. *Pediatric Neurosurg*. 2000;32(6):321–6.
6. Australian Vice-Chancellors'Committee. National statement on ethical conduct in human research. Canberra: NHMRC; 2007. Available from: https://www.nhmrc.gov.au/about-us/publications/national-statement-ethical-conduct-human-research-2007-updated-2018.
7. Berleur MP, Cordier S. The role of chemical, physical, or viral exposures and health factors in neurocarcinogenesis: implications for epidemiologic studies of brain tumors. *Cancer Causes Control*. 1995;6(3):240–56.
8. Bartolomei J, Christopher S, Vives K, Spencer D, Piepmeier J. Low grade gliomas of chronic epilepsy: a distinct clinical and pathological entity. *J Neurooncol*. 1997;34(1):79–84.
9. American Brain Tumor Association . Available from: https://www.abta.org/.
10. National Cancer Institute . Available from: https://www.cancer.gov/.

11. Living with a brain tumor: Dr. Peter Black's Guide to Taking Control of Your Treatment. Owl Books; 2006.
12. Black PM. Living with a Brain Tumor: Dr. Peter Black's Guide to Taking Control of Your Treatment. 1st ed. New York NY: Owl Books; 2006. p. 338.
13. Lewandowska AM, Lewandowski T, Rudzki M, Rudzki S, Laskowska B. Cancer prevention - review paper. *Ann Agric Environ Med*. 2021;28(1):11–9.
14. Storme GA. Breast Cancer: Impact of New Treatments? *Cancers (Basel)* . 2023;15(8):2205. doi:10.3390/cancers15082205.
15. Beaumont A, Whittlei R. The pathogenesis of tumor associated epilepsy. *Acta Neurochir*. 2000;142:1–15.

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